THE GAS JOURNAL

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A Glance at the Contents—

Carbonization of Somerset Coals.

This was the subject of the Presidential Address of Mr. S. Hole, of Bath, to the Western Junior Gas Association on the occasion of their annual meeting at Bath. [p. 265.]

Economics of Gas in Industry.

The economics of gas in industry was dealt with by Mr. K. H. H. Langford, of Cardiff, in a paper before the Wales and Monmouthshire Junior Gas Association. [p. 257.]

Colombo Gas and Water Company.

The Annual General Meeting of this Company was held at 148, Gresham House, Old Broad Street, E.C., on April 23—Mr. Robert H. Glen, F.C.A. (Chairman), presiding. [p. 269.]

Gas and Water Engineer Required.

Applications are invited by the Rhondda U.D.C. from qualified engineers under the age of 45 years for the position of Gas and Water Engineer and Manager at a commencing salary of £500. [p. 279.]

Cape Town Gas Light and Coke Company.

The Chairman of the Cape Town Company (Mr. C. W. Lilley) explained at the Annual Meeting on April 27 the circumstances which caused the Directors to recommend the passing of their dividend on this occasion. [p. 270.]

Huthwaite Gas Order—Question of Bulk Supply.

Some rather unusual points arose at the inquiry held at the Board of Trade Offices on April 27 into a Special Order promoted by the Huthwaite (Notts.) Urban District Council. [p. 272.]

Heat Treatment by Gas in Motor Works.

Members of the Birmingham Gas Committee visited the works of the Wolseley Motors (1927), Ltd., and inspected the new plant for heat treatment which has proved very successful. [p. 253.]

Reconstructed Carbonizing Plant at Rothesay.

Details are given of the reconstructed carbonizing plant at the Rothesay Gas-Works, with particular reference to the new waste-heat boiler installation recently put in by West's Gas Improvement Company, Ltd. [p. 256.]

Industrial Research at Rotherham.

In a paper before the Yorkshire Junior Gas Association Dr. F. Heathcoat described the results of research in industrial gas usage at Rotherham, in particular the pretreatment of town gas for atmosphere control in a continuous strip normalizing furnace. [p. 259.]

Forthcoming Engagements

May 3.—MIDLAND JUNIOR ASSOCIATION.—Annual Meeting. Address by Mr. R. S. Ramsden.

May 4.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Annual Business Meeting.

May 4.—NORTH OF ENGLAND ASSOCIATION.—Annual Meeting at the County Hotel, Newcastle-upon-Tyne, 2 p.m.

May 7.—GAS COMPANIES' PROTECTION ASSOCIATION.—Meeting of the Committee, 2.30 p.m.

May 7-10.—CERAMIC SOCIETY.—Spring Meeting of Refractory and Building Materials Sections, Llandudno.

May 8.—N.G.C.—Annual General Meeting, Hotel Metropole, W.C. 2, 2.30 p.m.

May 9.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Visit to Mossley. Paper by Mr. T. Hibbs.

May 9.—S.B.G.I.—Annual General Meeting and Dinner, Hotel Metropole, London.

May 9.—INSTITUTE OF FUEL.—Meeting at Burlington House, W. 1, 6 p.m. Paper by Major M. Koopman on "The Distribution and Utilization of Coke Oven Gas in the Heavy Industries."

May 10.—SOUTHERN ASSOCIATION.—Western District Commercial Meeting at Exeter, 2.30 p.m.

May 10 & 11.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Spring Meeting at Cleethorpes.

May 11.—B.C.G.A.—Midlands District Conference at Leicester.

May 12.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Annual General Meeting and Paperette Day in Heriot Watt College, Edinburgh.

May 16.—B.C.G.A.—Meeting of Executive Committee, 12 noon.

May 17.—MIDLAND ASSOCIATION.—Spring General Meeting at Leamington.

May 17.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Cardiff.

June 5-8.—I.G.E.—Annual General Meeting, London.

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Page 14. CAMBORNE. E. S. Buckley appointed W.M.

Page 84. EYEMOUTH. J. M'Callum, M., retired.

EDITORIAL NOTES

"Bats"

FOR long we have emphasized how necessary it is that we should carbonize cleaned coals—how expense entailed in the cleaning process is amply repaid not only in increased capacity of gas-making plant, but also in a more saleable coke. Part of the Presidential Address of Mr. S. Hole to the Western Junior Gas Association is concerned with this matter, and he explains how by purchasing cleaned coals and taking special pains to grade the coke produced and sell it with a very small moisture content the Bath Gas Company has built up an important local demand. In fact, the demand represents a high percentage of total coke sales, and Mr. Hole mentions that last January the Company was supplying graded coke for hot water boilers and plant of a similar type at the rate of over 100 tons a day.

A strict check is kept at Bath to ensure uniformity of coal quality, the agreed datum between the Company and the Collieries being 9-10% of ash. Now this uniformity has a most important bearing on the coke market, because without uniformity in the quality of coke sold there is bound to be dissatisfaction. A consumer sets the dampers of his coke boiler to deal satisfactorily with a delivery of coke. All is well, the boiler will without any trouble keep alight overnight and the morning bath is assured. Then another consignment of coke is delivered by the same gas undertaking, but the coke, which is, as before, "boiler nuts," is quite different from the other, and the consumer has to develop a new technique to obtain his bath. If a gas undertaking expects to do business for long on these lines it is a bit of an optimist, and yet many undertakings do not consider the consumer in this respect. For which reason we are glad that Mr. Hole calls attention to the value to the gas undertaking of supplying *uniform* coke. Goodwill is built up by uniform coke more than by any other factor.

Somerset coal seams are of such a character that an inherent ash content of 6-7% is expected on straight coal from the seam, and it is difficult to avoid bands of foreign matter in the actual lump coal. The consumer, Mr. Hole finds, rarely complains of the inherent ash in his coke. On the other hand, complaints are received if the coke contains bats and pieces of shale. Very rightly the Bath Company are very careful to avoid the sale of bats, and many undertakings might well pay more attention to this matter. Either washing or dry cleaning reduces the percentage of ash in coal by eliminating free impurities, such as shale, slate, and pyrites. It is difficult, however, entirely to eliminate shale, and one sometimes finds the ash in a cleaned coal higher than one would expect, though the cleaning plant may be operating satisfactorily. This, as was pointed out by Mr. Arthur Marsden, of Bristol, in our columns just over a year ago ("JOURNAL" for April 5, 1933), may be due to the nature and distribution of the extraneous ash. Mr. Marsden's work on the subject of distribution of ash in coal is of such consequence that we offer no excuse for reiterating his main findings. Two coals may pass through a cleaning plant, one having a higher ash content than the other, and both may leave the plant with the same ash content. The reason for this is the presence in one of the coals of bands of stone and shale which run through the pieces of large coal. Ash percentage in a coal is not a guide to the amount of bats the coke from it will yield. It is, in fact, quite possible to have a coal with a high ash content (say, 12%) which will produce a coke capable of giving better service in domestic coke boilers than another coal containing only half as much ash, or even less. Mr. Marsden has evolved an excellent method of bat detection, of which much greater use might well be made; and it is with pleasure that we note that the Bath Gas Company have not failed to take advantage of Mr. Marsden's valuable work.

Industrial Gas Research

OUR pages to-day contain much evidence of the progress which is being made in the application of gas to industrial processes—progress which quite definitely has research as the root cause. The value of co-operative research in the industrial field is well demonstrated by both the contribution of Dr. F. Heathcoat and the paper by Mr. K. H. H. Langford. The former is working in close association with the Rotherham Gas Department—an undertaking which is going ahead with the industrial sales by leaps and bounds. Already the industrial load is a matter of 52% of the total sales, and it is becoming increasingly obvious that a vast amount of potential business exists. Research will prove the key which opens the door to this new business. In Dr. Heathcoat's article a method of preparing neutral furnace atmosphere suitable for the treatment of steels of any carbon content in muffle furnaces is described. The method consists in passing town gas through preheating tubes prior to its passage through the muffle furnace. A process of regulated carbon decomposition occurs in these preheating tubes due to the pyrolysis of the hydrocarbons present in the original gas, and the composition of the gas is altered by varying the rate of flow to give a neutral atmosphere for steel of any carbon content. The method, it will be noted, has been successfully used with a continuous strip normalizing furnace. This is the main subject of Dr. Heathcoat's contribution, but he also gives an account of the re-heating of wrought iron by crude gas—how this industrial problem was tackled and how satisfactory was the outcome. Other phases of industrial heating by gas investigated were enamel melting and the melting of brass and gun-metal.

The great advantage of the Gas Development Centres is shown by Mr. Langford by reference to some of the work accomplished by the Centre at Cardiff. Regarding the Centres generally he appeals—as we have appealed—for the whole-hearted support of every undertaking throughout Great Britain. Particularly, he stresses, does this apply to the smaller works, of which there are some 500 selling less than 50 million c.ft. a year, for they find it harder to meet competition effectively than do the larger undertakings. How varied are the tasks of the Cardiff Centre will be gathered from Mr. Langford's paper. As examples may be quoted the application of gas to soil heating and the irradiation of dough by infra-red rays from gas-heated equipment. "Consumers of this treated bread," we learn, "express their great satisfaction with it and consider it much more palatable than the ultra-violet radiated bread of the normal variety."

Then, in our news columns, is an account of an investigation by the Birmingham Gas Department into the application of gas to heat-treatment in the shops of Wolseley Motors (1927), Ltd.—an investigation which has resulted in a load of approximately 136 million c.ft. of gas per annum. The heat-treatment shops of this firm are among the finest in Europe, and the Gas Department rightly prides itself on the part that town gas as a fuel plays in the firing of the large number of furnaces installed. Finally, and reverting to Dr. Heathcoat's contribution, we would underline the following sentence: "The tendency in these days is for the consumer to demand a guaranteed product, and, although

such guarantees may demand expenditure on scientific research, the Gas Industry should be prepared to face it." We cannot expect to sell a furnace in the same way as we sell a gas cooker. A special type of salesmanship is required in the industrial sphere which must be backed up by adequate laboratory facilities.

Gas Suicides

In the House of Commons last week the Liberal Member for Walsall asked the President of the Board of Trade whether, in view of the increasing number of suicides through gas, he would make inquiries as to the practicability of introducing into town gas at the place of manufacture some " pungent or disagreeable chemical agent " which would render it more difficult for anyone attempting suicide in this way to do so. In his reply Mr. Runciman referred to the findings of the Committee on Deaths from Gas Poisoning in 1930. This Committee came to the conclusion that, while the number of deaths by suicide from coal gas poisoning has in recent years shown a disquieting increase, the number of accidental deaths from such poisoning shows no appreciable increase and remains at a figure which gives no cause for alarm. As for the addition of an irritant to gas, the Committee found that this was " neither desirable nor necessary having regard to the probability that intending suicides either would not be deterred thereby, or would seek, and find, some other means of suicide."

It is not a fault of the Gas Industry that its product is a medium which provides a smooth exit from life, and no reasonable man would argue that the number of suicides would be reduced if no Gas Industry existed. The fault lies with the suicidal state of mind, not with the means for committing suicide. To suggest that gas in itself is in any way responsible for the tormented mind of the would-be suicide, or for any increase in the number of those who destroy their own lives, is absurd. The notorious Mr. Smith who departed this life at the end of a rope found that water was a suitable medium for taking other people's lives; yet who would advance the theory that the addition of a distinctive smell to water would reduce the number of murderers, or that water should be so treated as to render it more unpleasant to drown in? Again, should a blunt edge be put on razor blades to make them less efficient instruments of self-inflicted death?

There is, however, one way in which public good could be done. Is it to the benefit of the nation that the Daily Press should exhibit such a morbid desire to " display " cases of suicide—and, it seems to us, particularly instances of suicide by gas? Is a man living, say, at Brighton so vitally interested to learn that someone in Galashiels—someone of whom previously he has never heard—has put his head in a gas oven? There is, in brief, far too much publicity about the whole suicide business, and it cannot make the weak-minded any the more balanced to have brought to their notice so insistently that Mr. or Mrs. X. has committed suicide by gas. It is the old story of the power of advertising.

Bait for the Unwary

A year ago the Pontardawe Council planned a bold move to oust gas. Actuaries and experts were engaged to formulate a system of electricity tariffs which would appeal to the public, and they certainly did produce an attractive scheme if it was only the well-known two-part tariff. For certain premises, including shops, it was decided to charge a prepaid amount of 19s. 6d. a quarter, and a commodity charge of 1¼d. per unit for current consumed. Some tradesmen swallowed the bait and paid large sums of money for the conversion of their premises from gas to electricity. That, as we have mentioned, was twelve months ago.

Now the Council is sorry about the matter, but not nearly so grieved as are the bait swallowers, who have been told by the Council to take notice that the charge of 19s. 6d. was a slight error. It should have been £2 18s. 6d.; and it will be £2 18s. 6d. in future. This has not unnaturally irritated the victims, and regret at the passing of a halcyon year was voiced in no uncertain terms at a meeting of the Ystalyfera Chamber of Trade last week. Not unnaturally, too, a resolution of protest against the increased tariff was carried without a dissentient. It really is bad luck. A Mr. Hanney mentioned *en passant* that his change-over from gas to electricity cost him £77, and that he would not have installed electricity had it not been for the Council's favourable terms in its printed offer. Mr. Hanney is sadder and wiser. The Chairman of the Meeting, Mr. Stanley Alexander, expressed sympathy with Mr. Hanney, who, along with other tradesmen who were tempted by the Council and did not resist the temptation has received such a nasty electric " shock."

The policy of the Pontardawe Council in this regard is surely open to criticism. What would be thought of a private firm if they secured the services of a man employed by a rival by offering him £1,000 a year and then, after twelve months, said how sorry they were that a mistake had been made—the salary should have been £300. What, too, would be thought of the man who accepted such a post without the slightest guarantee that his worth would not depreciate at such an alarming rate and to such an alarming degree. Our advice to the tradesmen of Ystalyfera is to look before they leap. Our suggestion to those who have been bitten is that they should grumble loudly.

This little story may help tradesmen in other parts of the Kingdom, and it should prove useful to our Industry in helping them to help themselves.

The Gum Problem—A Questionnaire

Only last week we suggested that we have done good service by keeping our readers well informed of an investigation of the various aspects of the problem of gum formation in town gas. This investigation, which is being continued, has already been in progress for the past thirteen years, the United Gas Improvement Company of Philadelphia being responsible for it. That our suggestion is merited appears to be shown by the action of the Joint Research Committee of the Institution of Gas Engineers and Leeds University, who have prepared a " Questionnaire on the Formation and Occurrence of Gum in Town Gas." The Chairman of the Committee, Mr. Thomas Hardie, invites engineers and managers of gas undertakings and others interested who could assist the Committee in its investigation of the problem of gum formation in the works and on the district to obtain a copy of the Questionnaire from the Secretary of the Institution at 28, Grosvenor Gardens, London, S.W. 1.

A Matter of Courtesy

In many ways gas undertakings can justly be proud of the fact that they place a high premium on service to the consumer and that the service idea is efficiently translated into fact. The public is in most cases exceedingly well served by the Gas Industry. For the most part now adequate showrooms are well equipped and appliances attractively set out. The consumer is treated with courtesy irrespective of whether his demand is small or large. Cookery demonstrations, and so on, are the order of the day. As to the purchase of apparatus, here again the consumer is in general well catered for by easy-payment terms. At the works more effort than ever before is exerted to see that the gas supplied to the town mains is of uniform quality, and at no time have distribution staffs done so much to ensure ample pressure at the point of gas usage. The Gas Industry's personnel is on the whole a very polite set. Consumers appreciate all this.

We could, of course, cite many more examples of the Gas Industry's good service. We must, however, call

attention here to a practice of some undertakings which is considered by consumers to be a piece of grave discourtesy. It is a case of ninety-nine good links in the chain of service being ruined by the weakness of the hundredth. It is dangerously farcical for any gas undertaking to a save a fraction of a farthing on the delivery of accounts if as a result the mode of delivery very properly annoys the householder. We know that there are districts where gas accounts—*not enclosed in an envelope*—are shot through letter-boxes to fall on the mat and be picked up by all and sundry, even the dog. And if it is an offence enough to put them through private letter boxes, it is a still worse offence to put them through a letter-box common to a group of flats. This practice, to our knowledge, is highly irritating to consumers, and in the interest of the essential maintenance of goodwill we call attention to it, and urge that postage savings of this kind are liable to be paid for dearly in other ways.

PERSONAL

Mr. W. J. SHELLEY, Assistant Engineer and Manager to the Hinckley Gas Department, was married to Miss Freda Jones, of Sheffield, on April 7.

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In his speech as Chairman at the general meeting of the Wharncliffe Silkstone Colliery Company, Ltd., Sir Archibald Mitchelson, Bart., announced that Mr. RALPH HALKETT, General Manager and Secretary to the Sheffield Gas Company, had been elected a member of the Board. "The Board," said the Chairman, "is following very closely the developments that are taking place in high-temperature, medium-temperature, and low-temperature distillation of coal. It is possible that when we next meet we shall have something of a more definite nature to report to you."

* * *

Mr. EDWARD CROWTHER, the Bradford Gas Engineer and General Manager, and Mrs. Crowther were recipients of presentations on April 25, at a social gathering at the Great Northern Victoria Hotel, to mark the esteem of those associated with the Bradford Gas Department, from which Mr. Crowther has left to take up the post of Engineer and General Manager to the Salford Gas Department. Mr. George E. Currier, Deputy Gas Engineer, presided over a gathering which included, in addition to many members of the staff of the Bradford undertaking, Alderman Cowie (Chairman of the Gas Committee) and Mrs. Cowie; ex-Alderman Geo. Walker (former Chairman of the Gas Committee and Past Lord Mayor) and Mrs. Walker; Messrs. Charles Wood, E. J. Sutcliffe, F. Sykes, and J. R. Wagget, former officials of the Department; and Mr. J. W. Horwill (Commercial Assistant, and Past-President of the Yorkshire Junior Gas Association). In the course of the speeches, reference was made particularly to the value of the team spirit in the Department and its contribution to sustained success and progress even when Bradford was going through a bad time.

Mr. Crowther was presented with a bookcase and Mrs. Crowther with a dressing-table clock.

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Mr. ERIC S. BUCKLEY, Assistant Works Manager to the Nuneaton Gas Company, has been appointed Works Manager and Distribution Superintendent to the Camborne Gas Company, Ltd.

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Mr. JOHN MCCALLUM, who for twenty years has been Manager of the Eyemouth (Berwickshire) Gas-Works, has just retired. In early life, he followed the occupation of a seaman, and later was employed for some years at Lasswade Gas-Works previous to his appointment to Eyemouth. Since Mr. McCallum came to Eyemouth, the total annual consumption of gas in the town has increased from two-and-a-half to six million c.ft. On his retirement, Mr. McCallum is taking up residence at Lochilphead, his birthplace.

OBITUARY

The death is announced, at the age of 83, of Mr. HENRY DURETT FOSTER, Chairman of the Bodmin Gas Company. He was also a Director, among other concerns, of the Bodmin Waterworks Company, and was on the Penzance Local Board of Barclays Bank. Mr. Foster was educated at Rugby and Trinity College, Cambridge.

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Mr. E. G. TULLY, youngest son of the late Mr. C. B. Tully, died suddenly at Church Stretton on April 25. Since the war he had been continuously occupied with the "Tully" process, and since the death of his father had been a Director of Tully, Sons, & Co., Ltd., of Newark-on-Trent.

Commercial Hustle 99 Years Ago

A story of hustle which would put to shame even some of the methods of modern enterprise comes to us from way back in '35—99 years ago. And it is not the story of a bubble, because it concerns the formation of the Hemel Hempstead Gas Undertaking, which is still an active unit of the Watford and St. Albans Gas Company.

The Chairman (Mr. F. H. Jones) has kindly sent us some copy extracts from the Minute Book of the Meetings of the Bailiff and Inhabitants of the Borough of Hemel Hempstead, relating to the formation of the Hemel Hempsted Gas Light and Coke Company, 1835. Note the dates:

Feb. 11, 1835.

A Meeting of the Bailiff and Inhabitants was held in the Town Hall, Hemel Hempsted.

To take into consideration the Prospectus which has been issued by Messrs. Barlow & Co. for forming a Company to light the Town of Hemel Hempsted with Gas.

It was resolved

1. That it is desirable that the Town should be lighted with gas.
2. And for that purpose it is the opinion of this meeting that a Company should be formed and a Capital raised in Shares of £10 each.
3. That a General Meeting of the Inhabitants favourable to the plan be held in the Town Hall on Friday, 27th day of March, 1835.

March 27, 1835.

At a Meeting of the Subscribers to the proposed Gas Light and Coke Company held at the Town Hall, Hemel Hempstead, it was resolved, *inter alia:*

That a Company be now formed for the purpose of lighting the Town of Hemel Hempsted with gas, to be called "The Hemel Hempsted Gas Light and Coke Company," consisting of those persons who have already subscribed their names for Shares; to act under a Trust Deed to be forthwith prepared.

That the Management of the affairs of the Company be confided to Five Trustees and Nine Directors, to be chosen from among the Shareholders; such Directors and Trustees to form a Committee of Management.

That the Directors immediately arrange for the purchase of a suitable piece of ground for the erection of the Works.

Monday, —— day of May, 1835.

A suitable piece of Ground for the Erection of the Works containing about 49 Poles having been purchased of the Honble. G. D. Ryder, the first stone of the same was laid on Monday, —— day of May, 1835, and the Buildings, &c., were so far completed that the Town was lighted up with Gas for the first time on Tuesday, the 1st September.

Independent of the usual Public and Private Lights, brilliant illuminations enlivened the Town and many Hundreds of Spectators came from all parts to witness the event which was extremely interesting.

AN EARLY COOKERY DEMONSTRATION.

On Friday, the 11th day of September, 1835. A Dinner to commemorate the Lighting this Town with Gas took place at the Town Hall on which occasion The Bailiff and about Forty Gentlemen of the Town and neighbourhood sat down to an excellent Dinner which was cooked by Gas in a Room adjoining the Hall. A liberal supply of Game was presented to the Committee by the Countess Of Bridgwater.

But the great attraction of the day arose from the circumstances that many Hundreds of Persons were admitted to witness the process of cooking by Gas, on which occasion Mr. Sharp of Northampton " the Patentee of the Gas cooking apparatus " attended for the purpose of explaining the same. The following is a list of the Roast, Baked, and Boiled, viz.: A Salmon " 16 lbs." boiled. A sirloin of Beef " 20 lbs." roasted. Two large Legs of Mutton, one roasted the other boiled. A Ham " 16 lbs." boiled. A couple of Fowls boiled; a couple roasted. Two Pigeon Pies baked. Two Plum Puddings boiled, and a large quantity of vegetables boiled and a quantity of Rolls and Cakes for Tea baked.

The dinner was serv'd up in good style and a splendid Dessert and good wines succeeded the substantials. After the Cloth was removed Many Loyal, Local, and Personal Toasts were given.

The greatest Harmony and conviviality prevailed and everyone retired highly gratified with the proceedings of the day.

THE NEWS OF THE WEEK

CONGRATULATIONS.

To mark fifty years' service to the Gas Industry the *Gas World* published a Special Jubilee Number as their issue for Saturday last. To the many congratulatory messages received by our contemporary we would add our own congratulations on both the reaching of 50 years of age and the publication of a most attractive Jubilee Number to commemorate the event.

The Summer Meeting of the Institution of Heating and Ventilating Engineers will be held at the Queen's Hotel, Hastings, on June 18, 19, and 20 next, in the course of which Mr. A. F. Dufton, M.A., D.I.C., will read a paper on " Some Heating and Ventilating Problems."

Northern Ireland Gas Managers will meet at the Belfast Corporation Gas Department Showrooms, Queen Street, Belfast, on Monday next, May 7, to discuss the organization of the Gas Industry of Northern Ireland, so as to enable it to meet the competition likely to be encountered in the future.

The Charge to Prepayment Consumers is to be reduced at Oswaldtwistle to 8·5d. per therm as from June 1, compared with an existing charge of 8·83d. per therm, a reduction of 0·33d. per therm. In other words, prepayment meter consumers have been charged 3s. 6·38d. per 1,000 c.ft., and this will be reduced to 3s. 4·8d. per 1,000.

Gas for Isolated Farms.—At the official inauguration of a new waste-heat boiler at the Rothesay Gas-Works, a description of which appears in the " JOURNAL " to-day, Bailie M. Buchanan, formerly Convener of the Gas Committee, said that in the Island of Bute were many farms which were dependent for their lighting on oil or candles, but the day might not be far distant when gas would be supplied in cylinders, as was done in Denmark.

A New Public Company, Stellite, has been registered with a capital of £250,000 in 5s. shares, to acquire certain of the rights and assets of the Moore Carbonizing Company, including the benefit of the trade mark " Stellite," to refine petrol, benzole, &c. The Directors are Major George W. Davey, Col. Archibald D. Murray, Major Henry S. Allfrey, George H. Butcher, William R. Chapman, Samuel Moore, and John M. Rigby. Solicitors: Linklaters and Paines, 2, Bond Court, Walbrook, E.C. 4.

A Midlands District Conference of the B.C.G.A. will be held at the Grand Hotel, Leicester, on Friday, May 11. A civic welcome will be extended by the Lord Mayor of Leicester (Alderman W. K. Billings, J.P.), and addresses will be made by Alderman H. Carver, J.P. (Chairman of the Leicester Gas Committee), and Sir Francis Goodenough, C.B.E. The afternoon session of the Conference will be of a semi-social character arranged mainly for ladies, and a short talk will be given by Mrs. Eileen Murphy, entitled " Planning the Home."

To Provide Employment for Gasfitters, who normally are displaced during the summer months, the Liverpool Gas Company are offering to fix gas fires at half the usual cost of installation. Rent will not be chargeable until Oct. 1.

A Municipal Year Book Supplement has been received from the *Municipal Journal*, 3 and 4, Clement's Inn, London, W.C. It contains the names of members of the County Councils in England and Wales returned at the triennial elections in March, 1934.

Glasgow and Coke Oven Gas.—The Special Sub-Committee which has been considering the offers to supply coke oven gas to the Corporation of Glasgow has decided to recommend that these offers be not considered further. The offers under consideration were made by Messrs. Wm. Baird & Co., Ltd., and Messrs. William Dixon, Ltd. Messrs. Baird offered to supply 6,250,000 c.ft. of gas per day at a price of 8·4d. per 1,000 c.ft. while Messrs. Dixon offered 4,000,000 c.ft. per day at a price which was to be discussed if the offer were considered.

Demonstrations of " Kitchencraft " are being held at Messrs. Fenwicks, of Newcastle, in co-operation with the Newcastle-upon-Tyne and Gateshead Gas Company. In addition to demonstrations of cooking, water heating, and laundering, short film talks are being given on " A Balanced Diet," dealing with food values; a lady lightning sketch artist gives demonstrations; while a cookery bureau service is available to give expert and helpful advice to individual inquirers regarding their cooking problems. Last year some 10,000 persons attended a similar demonstration at Messrs. Fenwicks.

Both Industrial and Domestic Consumers will benefit from the new system of charges that has been brought into operation by the Whitehaven United Gas Company. There is to be a scale by which gas will be charged at 5s. per 1,000 c.ft. for the first 2,000 c.ft., 4s. 7d. per 1,000 c.ft. for the next 3,000 c.ft., 4s. 2d. per 1,000 c.ft. for the next 25,000 c.ft., and so on down to a flat rate of 2s. 11d. per 1,000 c.ft. for all gas used over 150,000 c.ft. per quarter. Domestic consumers are given the choice whereby they can either pay for their gas on the block rate system or pay a fixed quarterly charge of 3s. 6d. per room, and get their gas at the low rate of 2s. 6d. per 1,000 c.ft. The new scale of charges comes into operation immediately.

South-Eastern Gas Corporation, Ltd.

Reference was made in our Stock Market Report last week to the dividend declaration of the Corporation, and since then the Directors' Report and statement of accounts for the period from Dec. 3, 1932 (the date of incorporation), to March 31 this year have become available. The Annual Ordinary General Meeting is being held to-day.

The revenue for the period, after providing for debenture

THE NEWS—*continued.*

interest and other expenses, amounted to £59,918 9s. 1d., and after deducting the preference dividend to March 31, 1934, and the interim ordinary dividend paid on Oct. 10 last, there remains a balance of £21,374 10s. 1d. available for distribution.

The Directors recommend the payment of a final dividend of 3%, less tax, on the ordinary shares, making, with the interim dividend already paid, a total dividend of 6%, less tax, for the year ended March 31, 1934. This will absorb the sum of £19,409 9s. 11d., leaving £1,965 0s. 2d. to be carried forward to the credit of the current year.

Institution of Gas Engineers.

Members of the Institution of Gas Engineers are invited to attend the Annual General Meeting of the Illuminating Engineering Society in the Hall of the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W. 1, on Tuesday, May 8, 1934, at 7.15 p.m., when a paper on "Recent Progress in Illuminating Engineering in the United States" will be presented by Mr. Samuel G. Hibben, B.Sc. (Director of Lighting for the Westinghouse Lamp Company, New York City).

Light refreshments will be provided at 6.30 p.m.

Tickets of admission can be obtained from the Secretary of the Institution of Gas Engineers, 28, Grosvenor Gardens, London, S.W. 1.

Members of the Institution of Gas Engineers are invited to attend the Meeting of the Institute of Fuel at the Chemical Society's Rooms, Burlington House, Piccadilly, W. 1, at 6 p.m. on Wednesday, May 9, 1934, when a Paper by Major Koopman, of the United Steels, Ltd., on "The Utilization of Coke-Oven Gas" will be presented and discussed.

Advance copies of the Paper can be obtained from the Secretary, The Institution of Gas Engineers, 28, Grosvenor Gardens, London, S.W. 1.

Copies of the following recently issued British Standard Specifications may be obtained, price 2s. each, from the Secretary of the Institution of Gas Engineers.

No. 228—1934.—Steel Roller Chains and Chain Wheels (Revised April, 1934).

No. 327—Part I.—1934.—Derrick Cranes (Power Driven) (Revised April, 1934).

Members of the Institution of Gas Engineers are invited by the Physical Society to attend the 19th Guthrie Lecture, which will be given by Prof. C. B. Boyes, A.R.S.M., LL.D., F.Inst.P., F.R.S., Fellow of the Imperial College, on Friday, May 4, at 5 p.m., on "My Recent Progress in Gas Calorimetry," at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, S.W. 7. Tickets of admission are not required.

Mr. J. D. Smith Opens Coleraine Exhibition.

Ten Years' Progress.

Mr. J. D. Smith, J.P., Engineer and Manager of the Belfast Gas Department, performed the opening ceremony of an Exhibition of gas cooking, heating, and lighting appliances promoted by the Coleraine Gas Department, in the Town Hall, Coleraine, on April 23.

The Mayor (Alderman D. Hall Christie, M.P.), who presided, said the output of the local gas undertaking had increased in the past ten years from 23 million c.ft. to 69 millions. Ten years ago the price of gas in Coleraine was 4s. 2d. per 1,000 c.ft.; to-day it was only 2s.

Mr. Smith said the supply of electricity had undergone considerable development in that district of late, and some might think this Exhibition was intended to prove that there was no use for it. It was agreed that electricity had its uses, just as much as gas had, and there was plenty of room for both to be of service to the community. They were quite ready to admit that for certain purposes electricity was almost as cheap and convenient as gas, but on the other hand there were many spheres, notably the domestic one, in which gas was supreme, both on the score of cost and convenience. This has been proved time and again wherever an electric supply had been developed.

A vote of thanks to Mr. Smith was accorded on the motion of Alderman R. F. M'Cartney, J.P., seconded by Alderman D. Cunningham.

Yorkshire Junior Gas Association.

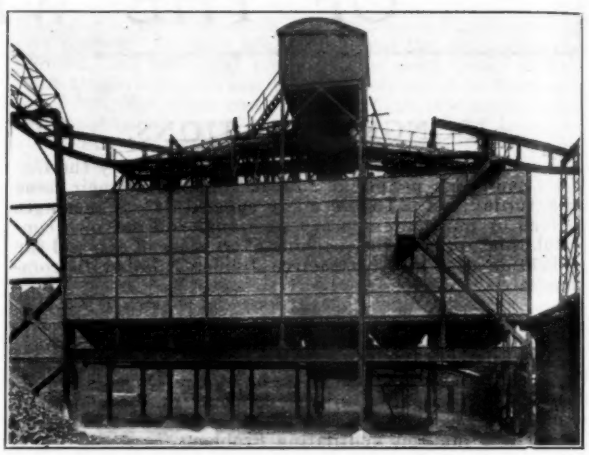
Meeting at Rotherham.

The members of the Yorkshire Junior Gas Association assembled on April 21 at Rotherham, by invitation of the Rotherham Corporation Gas Committee. The party met at the offices and showrooms of the Gas Department in Frederick Street, where they were welcomed by the Engineer and General Manager (Mr. J. T. Haynes). After an inspection of the showrooms and repair shops, they proceeded to the Rotherham Corporation gas compression plant for road transport (dealt with in a paper published in the "Gas Journal" for April 4 last). The operation of the plant was demonstrated in the presence of the gathering.

Subsequently the party proceeded to the College of Technology and Art, where Dr. F. Heathcoat, Lecturer in Chemistry and Fuel Technology at the College, read a paper on

"Scientific Research as an Aid to Industrial Gas Salesmanship."—See later pages.

New Coke Handling Plant at Leeds.



A new coke handling plant was formally opened at the New Wortley Works of the Leeds Gas Department on Monday, April 23, by Alderman R. Tortington, J.P., Chairman of the Gas Committee. A vote of thanks to the Chairman was proposed by Alderman Fred J. West, C.B.E., General Manager of West's Gas Improvement Company, Ltd., seconded by Mr. E. H. Hudson, of Normanton. The reply of the Chairman was followed by remarks from Mr. C. S. Shapley, Engineer and General Manager to the Leeds Gas Department.

The coke produced from the horizontal retort house is transported by means of telpher to a West-Calvert coke cutter, and provision is made in the feeding arrangement for the cutter to be by-passed if required.

From the cutter, the coke is fed on to a 24-in. wide band conveyor of the five-roller, ball-bearing type, and thence is conducted to a West lipped-bucket conveyor, having a capacity of 25 tons per hour.

The lipped-bucket conveyor elevates the broken coke to the top of a double battery of storage hoppers, above which the coke is fed on to a West coke grader of the double-deck, balanced, reciprocating type. This coke grader produces the following sizes at the rate of 25 tons per hour: Over 2¼ in., 1¼ in.-2¼ in., walnuts 1 in.-1¼ in., screened beans ⅝ in.-1 in., dust 0 in.-⅝ in.

From the West coke grader each size of coke can be fed to either battery of storage hoppers by means of diverting plates, operated by handwheel and worm gears.

The two compartments in each battery of hoppers are being arranged with cast-iron spiral chutes to lead the coke into the hoppers, and each spiral is composed of a number of quadrants four to one complete pitch bolted together.

Severn Valley Gas Corporation.

The offer of the Corporation to acquire the ordinary stock of the Cheltenham and District Gas Company has been accepted by more than half the individual holders, representing approximately 46% of the issued stock. The purchasers accordingly extended the date for acceptance until yesterday.

They have also agreed to give effect to the offer even if the total amount tendered should fall below the 55% stipulated.

THE NEWS—continued.

SIR ARTHUR DUCKHAM MEMORIAL FUND

Official List of Donations from April 21 to April 27

The Committee hope to be in a position to endow a "Duckham Research Award," to be applied for the period and purpose of specified investigations of interest to the Gas Industry, at places, at home or abroad, selected as being appropriate for the conduct of each particular investigation. Subscribers, therefore, are not only paying a tribute to the memory of Sir Arthur Duckham, but are also assisting to strengthen the Gas Industry at a critical period of its development.

Name and Town.	Amount. £ s. d.
Aberdare and Aberaman Consumers' Gas Company	2 2 0
Drakes, Ltd., Halifax	5 5 0
Haslemere and District Gas Company	5 0 0
H. J. Ibbotson, Newport, Isle of Wight	10 10 0
Lancaster Corporation Gas Department	10 10 0
T. H. F. Lapthorn, J.P., Southsea	1 1 0
Leamington Priors Gas Company	10 10 0
Luton Gas Company	21 0 0
Morpeth Gas Light Company (1902), Ltd.	1 1 0
Neath Corporation Gas Department	12 10 0
R. J. Restall, Stalybridge	1 1 0
Runcorn Gas Company	7 7 0
E. P. Senior, Argentine	1 0 0
Sittingbourne District Gas Company	5 0 0
Whitehaven United Gas Company, Ltd.	2 2 0
S. A. Wikner, Newcastle-upon-Tyne	1 1 0
Donations (16) paid above	£ 97 0 0
Donations (494) paid previously	8,932 3 6
Total Donations (510) paid	£9,029 3 6
Donations (14) promised	666 4 0
Total Donations (524) paid or promised	£9,695 7 6

"Natural" Gas in Bombay.

Chemistry and Industry for April 27 states that huge quantities of natural gas, containing traces of oil, have been found in Bombay Presidency, and there is every indication, according to a geological expert, that these gas fields can be opened for commercial exploitation.

Mr. Sultan Chinoy, a well-known Bombay merchant, has obtained prospecting licences. The sites are in Ahmedabad and Broach districts. He thinks it is possible to develop the natural gas industry in India on the lines on which it has developed in America.

The gas found has an odour of petroleum, indicating its existence in the vicinity.

Association of Tar Distillers.

The Surface for British Roads.

The annual dinner of the Association of Tar Distillers, at the Café Royal, Regent Street, W., on Tuesday of last week, was a markedly enjoyable function for the 120 or so members and guests who were present. This enjoyment proved none the less on account of the fact that the proceedings on these occasions are always of a more or less informal nature. Captain C. F. Ward Jones, the President, was in the chair, and in introducing the speakers emphasized the importance of the tar industry. This importance was certainly never so great as at the present time, when so much attention is being given to the improvement of our roads, to meet the altered conditions introduced by the growth of motor traffic upon them. With the creation of the slogan "British Tar for British Roads," not only has tar itself increased in importance, but the responsibility has been placed upon distillers of providing an article of consistently good quality for the purpose, and this responsibility they will not shirk.

The incoming President, Mr. J. Reginald Lane (whose portrait appeared on p. 194 of last week's issue of the "JOURNAL"), proposed the health of the guests, the principal of whom was Dr. E. L. Burgin, Parliamentary Secretary to the Board of Trade, who opened a witty response by remarking that a speech of thanks for such hospitality as he had received that evening could not be composed of the one word "Tar!" He felt the Association could play their part in the regeneration of the coal industry, which was of vital importance to this country.

The second response for the guests was by Mr. Reginald G. Clarry, M.P., Chairman of the British Road Tar Association, who, paying a tribute to the tar distillers, remarked that credit was due to them for the way in which they were endeavouring to meet fully the demands made for specialized tar for the roads of this country. He thanked the tar distillers heartily for the support they were giving to the British Road Tar Association, which was an essential factor in developing a particular side of the tar industry.

Reply was also made by Col. W. M. Carr, Vice-President of the Institution of Gas Engineers, who cited the tar distiller of to-day as an example to the country of what could be done by co-operative working as between the producer and the distiller. There were now, he said, a large number of co-operative schemes in operation, which were working to the advantage of both parties. He expressed appreciation of the help that had been given by Government Departments.

The Association was toasted at the call of Prof. G. T. Morgan, and the President, in his reply, acknowledged the good work done for the Association by the Secretary, Mr. J. Davidson Pratt, O.B.E.

Heat Treatment by Gas in Motor Works.

Success of a Modern Installation.

The installation of a complete plant for heat treatment at the works of the Wolseley Motors (1927), Ltd., Drews Lane, Ward End, Birmingham, has proved a great success.

Members of the Birmingham Gas Committee, accompanied by the Chairman, Mr. R. H. Hume, and Mr. A. W. Smith (Secretary and General Manager of the Department), Dr. C. M. Walter (Research Department), Mr. W. P. Timbrell (Accountant), and Mr. A. Lee (Assistant Secretary), visited the works and inspected the plant on Wednesday last.

The heat-treatment shops are among the finest in Europe, and the Birmingham Gas Department rightly prides itself on the part that town gas as a fuel plays in the firing of the large number of furnaces installed.

A little over two years ago, these heat-treatment shops, with the exception of one or two furnaces, were running on a competitive fuel, and in a discussion with one of the Department's service engineers, it was revealed that considerable expenditure was to be incurred to improve the availability and quantity of the fuel then utilized. The Gas Department were given the opportunity to prove that town gas could be utilized to a greater efficiency and with considerable economy.

The plant at that time consisted of oven furnaces of various types used for carburizing, normalizing, re-heating for hardening, and rotary carburizing furnaces.

A series of tests was then arranged, and one example of each type of oven furnace selected for trial with their existing fuel and, after suitable modification, with town gas as a fuel. At the same time one of the latest types of recuperative town gas fired carburizing furnaces was installed with a view to comparing the results of this with the older types of furnace running on town gas.

These tests extended over several weeks, and the results proved conclusively that town gas could be applied to their existing furnaces with improved efficiency of combustion, resulting in a net saving on fuel cost of about 15%, as compared with the results obtained under the previous conditions.

Costs of production of their own fuel were carefully examined, and the improvements in efficiency to be obtained by the use of town gas justified the use of the latter fuel at the price the Department could supply.

A complete change-over to town gas firing was made during one week-end, and since that time additional furnaces have been installed. The installation now consists of no fewer than ten Gibbons recuperative type carburizing

THE NEWS—continued.

furnaces, each having a hearth area approximately 7 ft. by 4 ft., and automatically controlled, operating on low-pressure gas, together with a battery of twin oven furnaces operating on low-pressure gas and pre-heated air at low pressure. Two batteries of re-heating furnaces of the Incandescent Heat, low-pressure recuperative type, have also been installed, together with a number of automatically controlled rotary table furnaces, rotary carburizing furnaces, and several smaller furnaces. An improved type of walking beam furnace has also been recently installed in connection with the normalizing of steel components.

The whole control apparatus, apart from that on the furnace, including the recorders, is housed in one room under supervision of the metallurgist in charge of the heat-treatment shops.

Lord Nuffield, then Sir William Morris, in his capacity as President of the League of Industry, at a Conference in September, 1933, said: "Why cannot we use the products of coal, even though a little more expensive?" Was it not better in the long run to pay a little more for our own products? At his Birmingham factories, millions of cubic feet of gas were used per annum, and he could say that they were saving money by using gas, which was produced from coal."

At the Drews Lane Works the Wolseley Company is now taking town gas to the extent of approximately 136 million c.ft. per annum.

Dr. Walter states that it has been established beyond question that, although gas may appear on the face of it to be a more expensive fuel on thermal cost, the actual utilization efficiency has proved to be so high that the firm has found the all-in cost to be reduced.

Institute of Fuel.

Officers and Members of Council.

At the Annual Corporate Meeting of the Institute of Fuel held on Wednesday, April 25, it was announced that Sir John Cadman, G.C.M.G., D.Sc. (Chairman of the Anglo-Persian Oil Company), had been elected President for the year 1934-35 and would assume office in October.

Mr. Roland Addy, M.A. (Managing Director of the Carlton Main Colliery Company), has been elected a Vice-President as from April 11 while the following have also been elected to the Council:

Mr. W. M. Selvey was re-elected a Member of Council.

Mr. Isaac Lubbock (Shell-Mex, Ltd.).

Col. Greenly, C.B.E., M.I.E.I., M.A., of Babcock & Wilcox, Ltd.

Mr. J. N. Warte (Electrical Engineer, Hull).

Dr. C. M. Walter (Birmingham Corporation Gas Department).

Dr. F. S. Sinnatt (nominated by the Department of Scientific and Industrial Research).

Mr. L. M. Jockel (nominated by the Electrical Power Engineers' Association).

Mr. R. R. Simpson (nominated by the Geological and Mining Society of India).

It was reported that Mr. T. Trimnell (the Institute's Hon. Legal Adviser) had recently died.

Melchett Medal and Lecture.

The Melchett Medal for 1934 has been awarded to Dr. Bergius, of Heidelberg, the originator of hydrogenation. Dr. Bergius will deliver the Melchett Lecture probably in October next.

S.C.I. Chemical Engineering Group.

The Annual Meeting and Dinner of the Chemical Engineering Group of the Society of Chemical Industry was held at the Waldorf Hotel, London, on Friday, April 27. Mr. W. A. S. Calder (Chairman of the Group) was in the chair at both functions.

The Committee's Report for the year records a slight fall in the membership during the year to 434, as against 448 in 1932. The Accounts for the year show a healthy financial position.

The Hon. Officers elected for the ensuing year are as follows:

Chairman.—Dr. W. R. Ormandy.
Hon. Secretary.—Mr. J. M. Leonard.
Hon. Treasurer.—Mr. F. A. Greene.

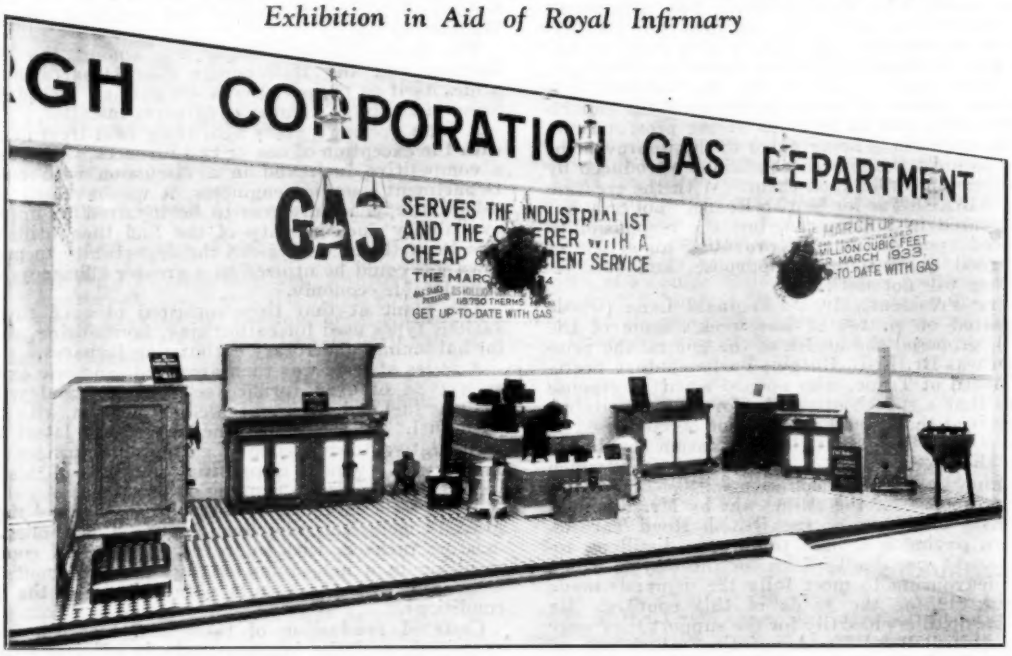
The Members of the General Committee elected to fill vacancies were Mr. W. A. S. Calder, Mr. M. B. Donald, Mr. Donald McDonald, Mr. B. A. Smith, and Mr. D. M. Wilson.

At the Annual Dinner which followed immediately after the Meeting, the guest of the evening was the Right Hon. Lord Rutherford of Nelson, O.M., F.R.S.

The Toast List was more or less of a formal character, but the principal item in the after-dinner proceedings was an Address by Lord Rutherford on "Trends in Modern Physics."

PRACTICAL DISPLAY AT EDINBURGH

Exhibition in Aid of Royal Infirmary



Above is reproduced a view of a display by the Edinburgh Gas Department at the Arts and Crafts Exhibition held in the Waverley Market on behalf of the Edinburgh Royal Infirmary. The exhibit included displays by Messrs. R. & A. Main, Ltd., Parkinson Stove Company, Ltd., Radiation, Ltd., Thermal Syndicate, and Geo. Bray & Co., Ltd. As a result of the display, over 300 orders were taken for all-enamelled cookers, while 170 inquiries were received for gas-heated water appliances. The efforts of Miss Maillings, the B.C.G.A. Cartoonist, aroused considerable interest.

IN CONTINENTAL COUNTRIES - - -

Abstract Translations from the Technical Press of France and Germany.

IMPROVEMENT IN THE QUALITY OF COKE FROM SAAR COAL.

The application of blending to the production of a special coke from Saar coal is described by O. Goergen in *Brennstoff-Chemie*, 1934, 15, 144-145 (April 15).

In view of their high volatile content, which ranges from 32 to 42%, the Saar coals are gas coals rather than coking coals. The coke produced is weak and irregular and of small size; hence it readily becomes crushed in the blast furnace. A further drawback of Saar coals is their high ash content.

For these reasons, blends consisting of 90% Saar coal and 10% Ruhr coal are carbonized, but the use of imported coal adds to the cost of the coke.

The French mine controllers at the Heinitz bye-product plant have for some years carried out research work directed towards improving the quality of Saar coke, and, to this end, a special research organization, Le Coke Métallurgique, was established. The process developed consisted in the carbonization of a blend of Saar coking coal and semi-coke made from a non-coking Saar coal. In 1928, a battery of five Salerni retorts was erected to provide the semi-coke required.

For Saar conditions, the material from which the semi-coke must be made has to be a coal unsuitable for the manufacture of coke and having a high volatile content. The necessary coal is obtained in two sizes: (1) 4 mm.-0 and (2) 8 mm.-0. Their respective characteristics are: Moisture 16·1 and 10·3%, volatile matter 33·9 and 35·4%, ash 9·3 and 8·3%. The semi-coke is made in two stages comprising drying and low-temperature carbonization. The coal leaving the drier at a temperature of 180°-190° C. passes directly to the Salerni retort connected thereto. Heating of the retort is controlled so that the distillation vapours, which leave at a temperature of 420°-440° C., are not subjected to cracking. The semi-coke, which has an ash content of 11-15%, leaves the retorts at a temperature of 250°-300° C. in the same degree of aggregation as that of the untreated coal—*i.e.*, in granular form. To prevent spontaneous ignition of the semi-coke, it is necessary to blend the coking coal (86-87%) with the semi-coke (14-13%) immediately the latter leaves the retorts. The coking coal is a washed product (35 mm.-0) containing moisture 11·2%, volatile matter 32·25%, and ash 8%. The blend, crushed in Carr disintegrators and containing moisture 8·6%, volatile matter 30·1%, and ash 8·5%, is carbonized in coke ovens. The following table shows the properties of the resulting special coke in comparison with those of the straight Heinitz coke and a Ruhr coke:

—	Volatile Matter.	Ash.	Drum Test.	Shatter Index.
	%	%	%	
Special coke . . .	4·45	12·3	52·4	79·8
Heinitz ,, . . .	4·7	12·5	21·0	61·0
Ruhr ,, . . .	..	..	90·0	80·0

The maximum daily throughput of the Salerni plant is 30-32 tonnes per retort per day or 160 tonnes per day in all. The yield of semi-coke is 72%. In 1931, 28,760 tonnes of semi-coke and 182,070 tonnes of coking coal were carbonized, 151,280 tonnes of special coke being produced.

The yield of low-temperature gas of calorific value 858 B.Th.U. per c.ft. is 1,430 c.ft. per ton of coal. It has hitherto been mixed with coke oven gas, but it is intended, later on, to make other use of the gas in view of its high calorific value.

The low-temperature tar, produced in a yield of 14 gallons per ton of coal, has a specific gravity of 1·05-1·06. It contains 7% of dust in comparison with a dust content of 2% in the coke oven tar. In 1929, the tar was a valuable commodity, and its selling value, per ton, was nearly twice that of coke oven tar. The price has, however, fallen to one-half its former level and the low-temperature plant is now no longer run at a profit but even increases the cost of coke manufacture. The installation of a tar distillation plant is proposed in the hope of a larger return from the distillation products than is obtainable from the tar itself.

Emphasis is laid on the fact that the costs incurred in the improvement of coke quality depend on the cost of the blending agent. When this is semi-coke, the factor deciding the cost is the return from the low-temperature tar, and success will depend on the discovery of special markets for this tar. Apparently, the Salerni process is governed by the same economic factors as influenced earlier low-temperature processes.

BOOK REVIEWS

HIGH-PRESSURE CHEMICAL PLANT.*

"The object of this book," states the author in a Preface, "is to describe personal experience of high-pressure chemical plant extending over many years and to bring together the scattered sources of published information on this interesting and increasingly important subject." The result is a thoroughly up-to-date work which will prove of value to all concerned with high-pressure plant—and the number grows daily. The following will give our readers an idea of the scope of the book: In an introductory chapter indicating the magnitude of the rôle played by high-pressure processes in modern industrial chemistry the author touches upon the synthesis of ammonia and discusses at length the hydrogenation of coal and oil. The next chapter is devoted to compressors for high-pressure gas compression, many compressors being described in detail. The compression of town gas for motor transport is dealt with in Chapter 3, which is headed "Use of Pressure in Preparation and Purification of Industrial Gases." The Claude and Linde air separation plants are described and a comparison is made of the various methods of producing hydrogen, with costs. Electrolytic hydrogen and the manufacture of hydrogen from methane and from coke oven gas and water gas receive attention as also does the manufacture of rare gases by pressure processes.

The author passes on to consider the design of pressure vessels for service at ordinary temperature, an important feature of this chapter being the regulations in force governing cylinders for permanent gases. The next chapter is concerned with pressure measurement, while Chapter 6 deals with valves, fittings, and pipework for high-pressure service at ordinary temperature. Then, in the next chapter, materials for service in high-pressure plant when exposed to high temperatures are discussed and the effect of low temperatures upon ferrous and non-ferrous materials is analyzed, with special reference to the recent work of Colbeck, McGillivray, and Manning on austentitic chrome-nickel steel and non-ferrous metals at very low temperature. The remaining three chapters deal respectively with the design and construction of the chemical autoclave, high-pressure catalytic circulatory plants, and the manufacture of large pressure vessels for high-temperature service. An appendix sets out critical data, the properties of carbon dioxide and ammonia, and the compressibilities of liquids and gases. There are, including the indexes, 420 pages and no fewer than 307 excellent diagrams and photographs.

* "The Design and Construction of High-Pressure Chemical Plant," by Harold Tongue, A.M.I.Mech.E., A.M.I.Chem.E., of the Chemical Research Laboratory, Department of Scientific and Industrial Research, Teddington. Published by Chapman & Hall, Ltd.; price, 30*s.* net.

GAS APPLIANCES.*

A book on the subject of gas appliances is very welcome. The fact that the appliances described are mainly those in use in Germany is no drawback, since it is possible to learn much of interest from a study of those features in which German practice differs from ours. In connection with gas cookers, for instance, duplex economy burners may be mentioned. These burners have a double supply of gas and the low-power supply comes automatically into operation when the flame is turned down and enables the burner to be used for simmering purposes. It is all the more remarkable that such burners are not in use in this country, since they have for many years been employed in Germany. The German domestic cooker also differs quite considerably from its English equivalent.

The book is divided into four chapters. The first is a

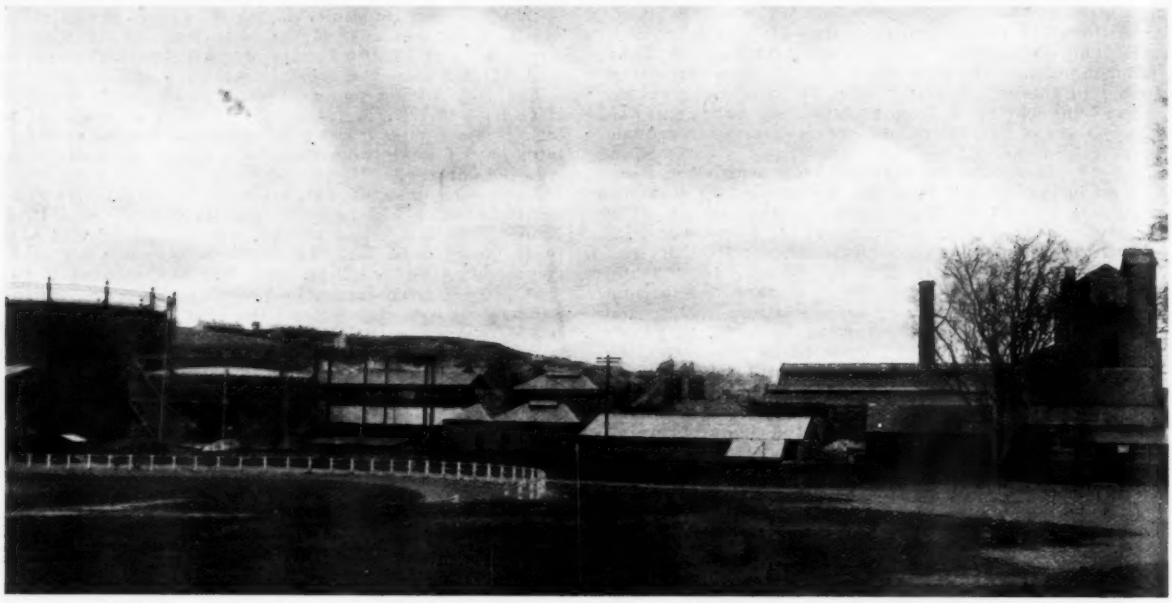
* Gasverbrauchsgeräte, by O. Huppert. Volume 33 of the series Kohle—Koks—Teer. [Halle (Saale), 1934, Wilhelm Knapp. Pp. viii. + 188. Price R.M.10.50 bound, R.M.9.25 unbound.]

short one devoted to a consideration of gas and electricity as alternative sources of heat and refers to the extensive development of the use of gas in Germany. Then follow chapters on the principles of combustion and the historical development of the gas burner. Consideration is given to luminous flame, non-luminous flame, and high-pressure burners. The last and longest chapter is devoted to appliances and deals with gas cookers for the household and hotel, grillers, plate washers, water heaters, space heaters of all kinds, laundry appliances, and refrigerators. Historical notes on the development of some of the appliances are given in addition to a description of the modern types which have been evolved. The illustrations, which number 190, add greatly to the usefulness of the book and will repay close study.

It is to be noted that the German Association of Gas and Water Engineers require that the carbon monoxide content of the air-free dry waste gas must in no case exceed 0·1% and, in the case of geysers and heating appliances the content must, so far as is possible, be kept below 0·05%. This implies proper attention to burner design, air supply, and waste gas evacuation. In this connection, the flame pictures obtained from burners under different conditions are of interest.

A plea is put forward for governors in every household and, in this connection, it may be remarked that the "Askania" water-heater is provided with its own governor. Apparently, low gas pressure is by no means rare in Germany, and the author rightly condemns this bad feature, which has to some extent counteracted the benefits which would otherwise have arisen from the adoption of standard gas in that country. In connection with water heaters, the author gives reasons in favour of luminous flames rather than non-luminous flames and, in discussing large gas cookers, considers the relative merits of exposed and covered burners and high-pressure and low-pressure burners. The subject of bafflers also receives adequate consideration.

Reconstructed Carbonizing Plant at Rothesay



A GENERAL VIEW OF THE ROTHESAY GAS-WORKS, SHOWING THE RECONSTRUCTED CARBONIZING PLANT AT THE EXTREME RIGHT.

As mentioned in last week's "JOURNAL," a new waste-heat boiler installed by West's Gas Improvement Company, Ltd., at the Rothesay Gas-Works was inaugurated by Bailie W. Jack, Convener of the Rothesay Gas Committee.

It was in 1915 that the Rothesay Town Council drew up a scheme of modernization of the gas-works, which materialized in an installation of Glover-West continuous vertical retorts of about 400,000 c.ft. daily capacity. This unit comprised twelve retorts of the 33 in. non-steaming pattern, with three producers each supplying fuel-gas to four retorts. Coal and coke to and from the plant were handled by a gravity-bucket conveyor and a steam-driven hoist. After fifteen years of good service this installation is now being brought into line with modern design.

The Council has been fully alive to the advantageous results of keeping abreast with the several important improvements introduced into vertical retort practice, and to this end a programme of alterations and additions has been and still is in operation.

The work was divided into sections, each section receiving attention in an order of priority determined either by the state of repair or by the extent of the reduction in production costs to be expected. There were obvious advantages to be gained by completing the work in stages rather than as a whole, and the work described below is that which has reached completion up to time of writing.

The retort bench has been reset in stages, incorporating an improved heating system and fuel-gas producers of the open step-grate type. The coal and coke conveyor has been converted from the gravity-bucket to the modern lip-bucket pattern, and an outside coal hopper of 70 tons capacity added. This enables a complete shipment of coal to be elevated immediately upon arrival, eliminating the old method whereby about one-half of each shipment was put into and subsequently taken out of stock, and effecting a considerable saving in handling costs.

The heat of waste gases from the setting is now reclaimed and utilized by means of a waste-heat boiler, in which steam is raised for general works purposes. The boiler is of the Spencer-Bonecourt induced-draught type, capable of generating 2,300 lbs. of steam per hour. The fan is driven by a steam turbine, and it is interesting to note that all the steam required for "steaming" the retort charge is supplied by the exhaust steam from the turbine. This means economy in fuel consumption and increased general efficiency of the plant. The steam supply for the entire works is drawn from this boiler, which has registered a further important economy by releasing two men for work in the distribution department.

The water in the boiler is kept at a constant level by a water regulator, well known as the "Thermofeed." Any undue rise or fall in the water level is at once communicated to the operator by the whistling of a "Hilo" water alarm. A series of flues and dampers is so arranged as to allow the waste gases from either or both chimneys to pass through the boiler.

The guaranteed results from the vertical retort plant have been constantly maintained, and in the process of modernization the output per retort has been brought up by 15%.

In spite of electrical competition, the absence of an industrial load, and the fact that no new housing estates are being developed, the annual sales of gas in Rothesay throughout the four years period over which the reconstruction work has been spread have been satisfactorily maintained. In the same period the price of gas has been reduced at various intervals to an extent totalling 6d. per 1,000 c.ft. on the ordinary flat rate and 6d. per 1,000 on the slot meter flat rate. Further, a scale of charges has been introduced which permits of the price of gas falling to 2s. 8d. per 1,000 c.ft. to the larger consumers.

Economics of Gas in Industry*

By K. H. H. Langford, of Cardiff.

It is generally recognized that gas is the major fuel for industrial heating plant and that rapid development is being made in better and more efficient equipment. We realize that one of the problems for the greater utilization of gas for industrial purposes is the cost the manufacturers must pay for their fuel. This is particularly true in those larger heating operations where tremendous quantities of fuel are used, and where the original fuel cost will always be one of the major cost items of the process.

The cost of gas to the manufacturer is slowly but surely being materially reduced through progress in various ways. One of these is better industrial rate structure. Important reductions in large-quantity gas rates for manufactured gas have become effective in many parts of the country during the past few years, due to gas undertakings differentiating between their various consumers, and selling gas at appropriate rates for particular classes of service.

During the past five years, the rapid development in all industrial processes and the growing intensity of competition demand from progressive industrialists the greatest efforts to improve methods of production, which depends to a great extent upon greater economy in the use of fuel. And there is a real need for industrial gas research departments with properly equipped laboratories staffed by highly trained industrial heat engineers. It is with this point in view that the country has been divided into a number of areas where industrial research and development centres have been set up.

As regards the value of applied research it does not require much intelligence to realize that it is of equal value during times of prosperity as in times of adversity. Industrial Gas Research Centres are one of the Gas Industry's greatest assets, and should have the wholehearted support of every undertaking throughout Great Britain. Particularly does this apply to the smaller works, of which there are some 500 in this country selling less than 50 million c.ft. a year, for they find it harder to meet competition effectively than do the larger undertakings.

The following gives an idea of the work carried out at the Industrial Gas Research Centre of South Wales and Monmouthshire:

(1) Application of gas to bread-baking.
(2) Application of gas to the bright annealing of metals.
(3) Development of furnace design.
(4) Research in the characteristics of burning gas with pre-heated air.
(5) Application of gas to ceramic firing.
(6) Development of gas to soft metal melting.
(7) Central heating.
(8) Application of gas to steam-raising and hot water supply.
(9) Mill roll heating.
(10) Soil heating.

Bread-Baking.

The Cox Super Heat Trap is the latest development in gas-fired ovens and is probably the most scientifically correct of any. The oven conserves the heat sufficiently to avoid excessive fuel consumption, and at the same time distributes the heat much more evenly than any other and gives the highest percentage of efficiency for the fuel consumed and the time worked. The oven consists of a large brick chamber underneath one side of which there is a comparatively small furnace consisting of small flat-flame burners, the number of which is varied to suit the size of the oven. They may be thermostatically controlled. The furnace has communication with the chamber (already referred to) by flues running under it, and upwards through flues in its four corners. The products of combustion, therefore, enter this chamber at the top but cannot find an outlet to the chimney until they descend to the bottom, for the openings of the flues to the chimney, of which there are four at the sides, have their open ends near the bottom of the large chamber. The effect of this arrangement is to make the highly heated products of combustion descend to the bottom, parting with their heat gradually on the way.

The baking chambers consist of iron flat boxes suspended or fixed within the heated chamber. The atmosphere of the latter being highly heated quickly by conduction passes the heat through the sheet iron to the interior of the baking chambers or boxes. The theory is that the heat in the large chamber should be alike throughout, but in practice it does vary slightly, and the variation is in the opposite direction to that shown in the ordinary type of decker oven. The top oven in this case, if there are two or three, one above the other, is hotter than the bottom one. The baking chamber is quite flat in each case, and has no direct opening into the hot chamber in which it is fixed. The heat throughout the oven, with a very slight exception referred to, is therefore uniform, and the writer is informed by those habitually using this type that loaves or other goods are baked with great regularity. The most advantageous point about this oven is the economy of fuel.

The arrangement of flues is conducive to a very slow draught in consequence of the drawing flues having their openings at the bottom of the heating chamber. The descent of hot air is naturally a slow process, so that when it gets to the chimney it is likely to be comparatively cool—much cooler than the hot air in the chimney of a side flue oven. This reduces the speed of the former. It is quite evident that the heat in such a furnace is likely to last longer than in one in which the draught is quick, because the air in the chimney, after it has passed its work, is very hot. The products of combustion in the Heat Trap oven part with the greater proportion of their heat in actually heating the baking chambers. The ovens are continuous or intermittent. They can be built in tiers of two, three, or more, and for use with peal or draw plates.

Recent consumption tests have given from 300 to 400 c.ft. of gas per sack of flour—a sack of flour being equivalent from 180 to 190 2-lb. loaves. When the gas is being turned down on completion of bread-baking, the oven may be worked for several hours with confectionery on stored heat; and after the oven has been standing for twenty-four hours, the little heat lost can be quickly regained.

Research work has been carried out at the Cardiff Industrial Centre on the irradiation of dough by infra-red rays from gas-heated equipment; and after three months' observation the following conclusions have been arrived at:

(1) The infra-red rays produced from Radiation Clinical Lamps stabilize the hydration of the gluten in the dough.
(2) This action increases the percentage of water taken into the dough and produces two or three quartern extra per sack of flour used.
(3) This extra moisture is held in combination with the dough or bread and is not evaporated by the baking in the ovens.
(4) This increased water content keeps the bread moist for several days, so preventing staleness after one day's exposure.
(5) The combination of water with the gluten under the influence of infra-red rays reduces the digestive resistance of the bread. This makes the bread break down more quickly under the action of the digestive juices in the stomach and intestines.

The work has been brought to the notice of various biochemists and analysts conversant with baking practice, and is still undergoing investigation.

Consumers of this treated bread express their great satisfaction with it and consider it much more palatable than the ultra-violet radiated bread of the normal variety.

Central Heating.

Until recent years very little effort has been made to secure a central heating load from the more commonly employed heating agents generally used for this purpose—*i.e.*, coal, coke, and oil—for the Gas Industry. To-day it is receiving a great amount of study and there is a growing demand for the gas-fired central heating boiler. The advantages of gaseous firing justify a much higher price than solid fuel on a heat unit basis. Generally the price of gas having the same scale of discount as granted for the manufacturing processes is extended to central heating.

Regarding coal and coke, the cheapest forms of solid fuel, their advantages are extreme simplicity, lack of danger, and the furnace may be used as a rubbish destructor, but it also has great disadvantages, calling for stoking accompanied by a possible heavy drop in circulating temperature. Also, it is very dirty and clumsy, while occupying much space. Its combustion is less under control than any other kind of fuel, and the furnace is slow in heating up, so that after a great deal of labour has been expended on the boiler, it is usually mid-day before the results can be appreciated, so that the advantage of cheapness is largely offset. With oil, the necessity of storage remains. Oil may be easily handled by pumping, it is easier to ignite, regulate, and extinguish than are solid fuels, although it is more difficult than gas.

* From a paper before the Wales and Monmouthshire Junior Gas Association, Meeting at Cardiff, March 17, 1934.

The combustion of oil requires intimate mixing with air, and if satisfactory atomization is not obtained an unpleasant smell of sulphur and the formation of soot are the results. Oil installations are very expensive, and the accessories required limit their use to large-scale work. The plant is liable to get out of order, and there is a good deal of potential danger attached to its use.

The outstanding features of a gas-fired boiler are cleanliness, convenience, simplicity, continuous feed, and, with the introduction of a control clock, igniting and extinguishing of the boiler may be arranged at any predetermined time. The value of automatic temperature control has been realized by horticulturists for greenhouse heating, the temperatures required varying with the different types of plant.

The following figures give fuel cost comparisons of coke-firing, and electric and gas heating, for a hot water system. The heat requirement is taken as 200,000 B.Th.U. per hour:

(1) *Coke Firing.*—Average hourly output of boiler, 200,000 B.Th.U. Assumed calorific value of coke, 12,500 B.Th.U. per lb. Sectional boilers are often rated at 75% efficiency, but at a rating as low as 50% the input of heat would be 6,250 B.Th.U. per lb. of fuel.

$$\text{Average consumption of fuel per hour} = \frac{200{,}000}{6{,}250} = 32 \text{ lbs.}$$

$$\text{Cost with coke at 1s. 6d. per cwt.} = \frac{18 \times 32}{112} = 5{\cdot}14\text{d. per hour.}$$

(2) *Electric Heating.*—Average hourly heat emission to building, 200,000 B.Th.U.

One electric unit = 3,412 B.Th.U.

$\frac{200{,}000}{3{,}412} = 58{\cdot}6$ electric units per hour.

This is assuming 100 % efficiency. Taking electricity at the minimum as ½d. per unit, 58·6 electric units at ½d. = 2s. 5d. per hour.

(3) *Gas Heating.*—Average heating per hour required for building, 200,000 B.Th.U.

One cubic foot of gas = 500 B.Th.U.

$\frac{200{,}000}{400} = 500$ c.ft. of gas per hour (80% efficiency).

Cost with gas at 2s. 6d. per 1,000 c.ft. = 1s. 3d.

These are fuel cost comparisons only. Any further comparisons depend upon:

(1) The cost of stoking a coke-fired boiler, treating it as part-time labour.
(2) The cost of removing ashes.
(3) The cost of insurance, if any.
(4) Thermostatic control of gas-fired boiler.

The Tinplate Industry.

The finished product of the steel makers—namely, the tinplate bar—is the raw material of the tinplate industry. In the tinplate works these bars are now cut into shorter lengths of 16 to 30 in., and a number of the shorter bars, commonly called a "heat," are placed into the mill furnaces, which are fired by gas or coal.

On being heated to the required temperature, these bars are then removed two at a time from the furnaces and passed singly through rolls for the purpose of "breaking" or "oughing," as it is called, to the required lengths. They are then placed into another furnace for further re-heating.

They are again rolled and doubled into what are termed "fours," and again returned to the furnace for re-heating. The process is again repeated with the "fours"—that is, they are again rolled and doubled into "eights." A final re-heating now takes place, and the eights, known as "common susbtance," are laminated into plates of the required length and thickness.

The plates are then sheared and separated preparatory to the pickling process, where each plate is dipped into an acid solution in order to remove any scale adhering to the surface of the plate. They are then placed into an annealing furnace, the plates being arranged in stacks covered with pots.

From the annealing furnace they are then sent to the cold rolls department, where they are passed several times through the rolls in order to obtain the necessary smooth surface preparatory to the tinning process. The plates are again annealed and pickled, and are finally dispatched to the tinning department to be coated with tin. The galvanized sheet process is almost identical with that of tinplate manufacture, except that the sheet is larger and is coated with zinc or spelter.

The gas burner equipment for the preheating of rolls is constructed of two small burners built as a single unit in order to give a better distribution of gas and air over the whole width, as the consumption of gas is comparatively low when compared with the length of the burner. The principle of the burner is the introduction of gas and air in layers or separate streams which, by the construction of the burner, are given a whirling action. This intensive method of mixing both the gas and air produces practically complete combustion with a globular flame together with the highest possible efficiency. The burner is fitted with a pin on each end which could rest in slots on floor brackets to enable the burner to be swivelled in order to obtain the most suitable angle of flame.

On rolls 24 in. by 28 in., the gas consumption per hour is approximately 500 c.ft., the rolls attaining a temperature of 750° F. in six hours with a total gas consumption of 3,000 c.ft. per pair per hour.

In industries to-day there are thousands of processes in which constant temperature is necessary if satisfactory results are to be obtained. This may be done by regulating the supply of heat by hand, so as to keep as constant as possible the reading of a thermometer or pyrometer placed in a furnace, oven, or other form of heated vessel; but this method is not infallible. A sudden change in the conditions, or temporary inattention, may result in considerable variations of temperature and consequent serious loss. Some form of automatic control is therefore essential if maximum economy and efficiency are to be secured; and the ease of automatic control strongly favours gas as compared with cruder fuels on most heating operations.

Many gas-fired furnaces need re-designing in order to bring their efficiency to a satisfactory figure, but the use of an automatic control will do much to modernize even an old furnace. Savings can be effected which at times exceed the highest expectations. Other economies besides fuel reduction are found in lessening the time or cycle of operation in the manufacture of a higher grade material, or a reduction in labour. These results can be truly attributed to gas, and in many cases will be a significant factor in making gas as cheap as, or cheaper than, a fuel which is less expensive on a straight B.Th.U. basis.

Discussion.

The President (Mr. H. S. Bartlett) drew a comparison between the thermal efficiency of a super-power station, with its loss of 78·4%, and the conservation of fuel by gas-works practice of 80%.

Mr. Edwards (Port Talbot) referred to the circulation of town gas around the tinplate sheets in the annealing pots to prevent oxidation on withdrawal from the sheet furnaces, and inquired if the author had any experience in this matter.

Mr. Langford said they were already engaged upon experimental work in this direction, and further information would be available at a later date.

Mr. W. E. Crowley (Newport) asked if it was practical to convert an oil-fired baker's oven to gaseous firing.

Mr. Langford, in reply, said it was practical. The gas consumption per sack of flour was very high, but depended entirely upon the design of ovens, and the method the baker had of operating his ovens. A gas consumption of 700 c.ft. per sack had been obtained.

Mr. B. J. Bell (Cardiff) stated that twenty-five years ago the first attempt to obtain the industrial load was made at Birmingham. Since that date immense developments had been made in this particular field, especially so in metallurgical work. Research entailed months of expensive experiments, which sometimes were not too encouraging, but no time was being lost by the various Industrial Centres dealing with such work, and the results were available to all Centres, by the interchange of information. The necessity of finding increased consumptions directed attention to the industrial load, both to help to make good the losses from various sources and expand sales generally. To meet the competition of imported oil a low price for gas was necessary, and they must not close their eyes to the efforts of their electrical friends in competition not only for the domestic, but also the industrial, load. A collective effort was being made by them to level up their peak loads, and needed careful watching. Competition in America between electricity and gas was so very keen that it resolved itself into salesmanship where the personal element was the determining factor. Contact with the consumer was of the utmost importance, even in the smallest detail, for additional business usually followed.

Mr. A. J. Cruise (Cardiff) agreed with Mr. Bell as to the necessity of reducing still further the charges for industrial gas if competition was to be successfully met.

Vote of Thanks.

Mr. A. D. Howells (Neath) proposed a vote of thanks to Mr. Langford, and remarked upon the excellent work being carried out by the Cardiff Industrial Gas Research Centre. He was of the opinion that 700 c.ft. of gas per sack was the average consumption figure of a steam tube baker's oven conversion. Regarding costs, he considered 1·8d. per therm was necessary to secure the annealing and mill rolling load of the tinplate industry. For soft metal melting, 2s. per 1,000 c.ft. was a maximum. Generally, the industrial load gas charges must come down still further.

Mr. A. E. Pask (Caldicott), seconding the vote, stressed the need for the alliance of the small undertakings with the Industrial Centres if competition was to be successfully met. In the tinplate industry, although producer gas and oil were cheap fuels, they led to trouble by the oxidation of sheets and discoloration, but with the utilization of coal gas all such troubles disappeared.

Mr. Langford, in reply, expressed his thanks for the encouraging remarks made by members of the Association.

Scientific Research as an Aid to Industrial Gas Salesmanship*

By F. HEATHCOAT, M.Sc., Ph.D., A.I.C., M.Inst.Fuel.

This paper is a plea for a wider conception of industrial gas salesmanship than has hitherto been generally held by those concerned with developing our industrial gas loads. There are signs on all hands that the Gas Industry is awakening to a sense of its responsibilities in the industrial gas field, and there is a growing sense of need for organized centres where information can be pooled and shared by all who wish to participate. This need has already crystallized out to some extent in the formation by the Industry of centres of this description. But at this stage it is perhaps pertinent to ask the question: Has our outlook been sufficiently wide and comprehensive in this matter?

The general nature of the services which these Development Centres are expected to afford has been set out in a Memorandum issued about a year ago by a Joint Committee of the three National Gas Bodies [see "JOURNAL" for Feb. 15, 1933, p. 356].

The scheme no doubt will commend itself to all who are interested in the sale of industrial gas. There is one point, however, that I wish to emphasize more particularly, and that is the statement to the effect that one function of the Centres will be "to compile the results of tests and experimental work at the Development Centre and periodically to forward the same to contributing undertakings." It is with the scope and nature of this experimental work that I am concerned in this paper.

When a manufacturer is contemplating the use of gas in his processes there are two questions that he puts having satisfied himself as to fuel costs:

(1) Will the equipment be efficient from the thermal and the manipulative point of view?
(2) Will the equipment produce a satisfactory product?

In order to answer these questions satisfactorily the Development Centres will therefore have to be competent in regard to staff and equipment to undertake research into:

(1) Furnace design.
(2) Chemical and physical tests on the product.

STAFFING AND EQUIPMENT OF INDUSTRIAL LABORATORIES.

This means in effect that the staff should consist of men with a wide technical knowledge of the industries concerned, of men experienced in furnace design, and not least of men with a wide chemical and physical training which will enable them to undertake tests as required, and at the same time to prosecute a consistent programme of research on the possibilities of gas as an industrial fuel. The laboratory equipment should be correspondingly adequate. It will not be a case of setting up merely a glorified showroom in which are housed a selection of standard furnaces, but a real industrial laboratory with equipment suitable for chemical and physical research and research into furnace design. This may sound rather ambitious, but laboratories of this type already exist at some of the larger undertakings. The idea, however, is capable of wider extension.

I am not forgetting that some of the larger works already possess adequate scientific staffs and laboratories of their own, but, on the other hand, the smaller potential customers do not possess these facilities, and in any case we cannot expect our customers to shoulder the whole of the burden of expense during the first experimental period. The tendency in these days is for the customer to demand a guaranteed product, and, although such guarantees may demand expenditure in scientific research, the Gas Industry should be prepared to face the matter. We cannot expect to sell a furnace in the same way that we sell a gas cooker. A special type of salesmanship is required in the industrial sphere which must be backed up by a knowledge and facilities of the type already indicated.

TACKLING AN INDUSTRIAL PROBLEM.

To come now to a few examples of the type of problem that arsies. The first is concerned with a question which arose as to whether crude gas could be used for the reheating of wrought iron. The whole question turned on the effect, if any, of the sulphur in the gas on the product. The only way to decide the matter was to heat the material in a small experimental furnace under the same conditions as would obtain in practice and then to submit the material to analysis and to photomicrographic examination. The original furnace at the works concerned was a large regenerative furnace which had been converted from producer gas to town gas. In this furnace, which is known as a "ball" furnace, scrap iron is heated in piles to a temperature of about 1,500° C. after which the piles are taken to the hammer, beaten and welded together and then re-rolled.

A small experimental furnace was constructed and fired with crude gas and air under pressure. A few samples of scrap iron were heated in this furnace after representative drillings had been taken for subsequent analysis. The samples were heated to the required temperature—1,500° C.—and held at this temperature for 20 minutes, after which they were removed and welded together. When cool the resulting bar was broken to examine its physical structure, which was found to be quite satisfactory. The sulphur content of the material was determined and was found to be exactly identical with the original—namely, 0·036%. On examining a polished section under the microscope the specimen was found to be free from sulphur inclusions, the welds were good, and the slag lines of very small dimensions. The experiment was carried out in both oxidizing and reducing atmospheres and gave identical results. The use of crude gas was therefore completely satisfactory.

ENAMEL MELTING.

The next example relates to enamel melting and its application. These experiments were carried out at the invitation of a local works where trouble was being experienced through the faulty porcelain enamelling of baths.

The faults were of three types—namely:

(1) Appearance of "specks" and "blowholes" in the enamel.
(2) Dull appearance due to fine cracks which assumed roughly the shape of tiny hexagons.
(3) Larger cracks which caused the enamel to scale off in some cases.

A visit was paid to the works to inspect the enamelling process. The enamel was being melted in a coal-fired furnace of the reverberatory type, the enamel constituents being placed at the top of the sloping hearth, when, after fusing, it ran down into the lower pit to be run off into water and cooled to "frit."

A fair amount of smoke was being produced in this furnace and the opinion was formed that particles of ash or coal dust could easily have found their way into the enamel at this stage. The temperature of the melt was also taken and found to be 950° C., which is low for this process. The enamel runs very sluggishly at this temperature. It was recommended that the temperature of melting should be increased. This was very difficult with this particular furnace, but a temperature of 1,060° C. was finally achieved.

Two batches prepared at the lower and the higher temperature were then ground to a powder and compared in regard to ease of application. It was found that the enamel which had been prepared at the higher temperature fused more readily during application and gave a better finish than that prepared at a lower temperature.

These experiments encouraged us to carry out further experiments in a gas-fired crucible furnace at the Rotherham Technical College, at still higher temperatures. A small batch was therefore heated to a temperature of 1.250° C., when it was found that the product subsequently fused and applied still more readily. The fusion points of two samples prepared at 950° C. and 1,250° C. were determined, and it was found that the fluid point of that prepared at 950° C. was 635° C.. whereas that prepared at 1,250° C. had a fluid point of 575° C.

It was suggested that the working temperatures hitherto employed were too low and that at these temperatures chemical homogeneity of the product was not achieved. This was reflected in the subsequent small cracks in the enamel when applied.

The specks in the original enamel were also examined and were found to be of two kinds—some were definite inclusions of foreign matter, others were small blow-holes. It was thought that these were formed by the decomposition of carbonaceous matter. In order to decide whether this was present in the enamel itself or in the metal surface of the bath in the form of carbides it was decided to pickle a bath in sulphuric acid before applying the enamel and to compare results. The result of this experiment suggested that the impurities originated in the enamel itself.

It was therefore concluded that the specks and blowholes were produced by inclusions of carbonaceous matter derived from the solid fuel employed in firing. This was supported by the fact that the specks were found to be

* From a paper before the Yorkshire Junior Gas Association.

carbonaceous in nature, and in one experiment in which carbon was added to the molten enamel it was found that carbon particles can survive a temperature of 1,250° C. followed by re-stoving of the enamel and giving rise to a dull enamel in consequence. The logical solution of the difficulty was therefore to employ a clean fuel. The use of gas could therefore be recommended with confidence, since it carried with it the following advantages:

(1) By the use of gas the presence of foreign matter would be avoided.
(2) Owing to the possibilities of higher temperatures being obtainable with gas firing, an enamel of chemical uniformity and of lower fusion point could be made.
(3) Precision in regard to temperature control is possible with gas; this is particularly important in the muffle furnace in which the stoving of the article is carried out during the application of the enamel.

Melting of Brass and Gun-Metal.

The next case relates to the melting of brass and gun-metal. The first experiments were carried out in an in-fired rotary tilting furnace. From the point of view of heat transfer this type of furnace is no doubt efficient, but it can only be used in those cases where the article is not affected by the direct action of the furnace gases. In the case of brass and gun-metal this is not the case; it was found that a considerable amount of oxidation occurred, particularly of the zinc constituent.

Experiments have more recently been carried out with a pit furnace, tangentially fired at the bottom with a burner in which the air and gas are pre-mixed. A crucible holding 100 lbs. of metal was used and fitted into the pit to leave an annular space of about 2 in. With a simple furnace of this type constructed by our clients at their own works and without any form of pre-heating arrangement, brass and gun-metal can be melted under workshop conditions at the rate of 5-6 c.ft. of gas per lb. of metal. This figure could no doubt be improved if some form of pre-heater were incorporated, but it is highly satisfactory to our clients who find that with gas at 10d. per 1,000 c.ft. the cost works out at less than one-half as compared with coke firing.

Furnace Atmospheres.

The last example, on which I wish to spend rather more time, is concerned with the question of furnace atmospheres, on which subject some interesting work has recently been carried out at this College and at one of the local firms.

The production of a neutral furnace atmosphere which is non-oxidizing and non-carburizing is desirable in many metallurgical heat treatment processes. So far, the production of such atmospheres in muffle furnaces has been effected by using either a gas which is essentially non-oxidizing and non-carburizing (*e.g.*, nitrogen) or by pre-mixing an oxidizing gas with a carburizing gas in such proportions as to give a mixture which is neither oxidizing nor carburizing.

The use of nitrogen is open to objection since there is evidence that nitrogen is capable of decarburizing steels under certain conditions, the carbon being removed in the form of unstable carbon-nitrogen compounds.

Among the methods which depend upon pre-mixing an oxidizing gas with a carburizing gas there are two that will be mentioned—namely, that due to Schultz and Hulsbruch (B.P. 283,200 of 1927) and that of the Sheffield Gas Company (B.P. 4,095 of 1933).

The process due to Schultz and Hulsbruch is mainly concerned with the use of mixtures of methane and hydrogen in the ratios of 10 to 40% of CH_4 by volume and 60 to 90% of H_2 by volume, according to the carbon content of the steel. It is stated in the patent specifications that with these mixtures carbon steels with 0·5 to 1·3% of carbon did not show any carburization on being annealed in the methane-hydrogen mixtures at 850° C. Schultz and Hulsbruch also suggest such mixtures as coke oven gas and air or coke oven gas and blast furnace gas. A necessary preliminary to the use of hydrogen-methane mixtures is a supply of pure methane and hydrogen and the correct proportioning of the gases for any special carbon steel.

The process advocated by the Sheffield Gas Company has been applied to small muffle furnaces and consists in leading back into the muffle chamber a portion of the flue gases, obtained by almost theoretical combustion, which have been previously cooled to diminish the water vapour content, together with a small proportion of unburned town gas in such proportion as to give inside the muffle chamber a "balanced atmosphere" which is neither oxidizing nor carburizing.

In the method now to be described the only control which is required is the adjustment of the rate of flow of town gas through a pre-heating tube where its composition is varied to suit steels of any carbon content in the subsequent muffle furnace. The equipment is simple and only requires a few minutes' attention every 24 hours.

It may be pointed out that any method of producing a neutral atmosphere in heat treatment operations is confined, in our present state of knowledge, to muffle-type furnaces. If, for example, town gas is burnt with theoretical air, the resulting atmosphere of CO_2 H_2O, and N_2 is still highly oxidizing, as the following figures of Angus and Cobb (*Journ.* Soc. Chem. Ind., 1927, 46, 61-72T) show:

Furnace atmosphere	Weight of scale produced (grm./cm.²) on boiler plate steel (0·2% C.) exposed to the atmosphere at 1,000° C. for 3 hours.
Dry air	0·0635
20% H_2O 80% N_2	0·0166
20% CO_2 80% N_2	0·0024

When both CO_2 and H_2O were present, intermediate results were obtained.

The following types of atmosphere were required in order to remove scaling entirely:

(1) 58% CO, 42% CO_2.
(2) 50% H_2, 50% H_2O.
(3) 57% H_2, 43% CO_2.
(4) 80% CO, 20% H_2O.
(5) 30% CH_4, 35% CO_2, 35% H_2O.

These results of Angus and Cobb show clearly that such atmospheres are almost impossible to produce with in-fired furnaces.

Pyrogenic Treatment of Town Gas for Subsequent Use as a Neutral Furnace Atmosphere.

The conception of introducing into the chamber of a muffle furnace town gas which had been pyrogenically decomposed in order to give a neutral furnace atmosphere arose during the course of investigating a difficulty that had arisen at one of the local steel firms.

At these works, a continuous strip normalizing furnace was in operation for normalizing steel strip at a temperature of 980° C. in steel muffle tubes, through which a constant stream of town gas was passed. It was found, after three or four weeks' usage, that the muffle tubes became completely blocked with solid carbon which seriously diminished the efficiency of heat transfer and finally made it impossible to pass the strips. This meant that the tubes had to be dismantled at intervals of three to four weeks and, as it was found impossible to remove the carbon either mechanically or by burning in oxygen without injury to the tubes, it was necessary to replace them completely. This led to considerable expense in time and materials.

At the same time heavy carburization of the surface of the strip, which had an initial carbon content of 0·09%, occurred, the outer layers containing 0·4% C. in one case (see figs. 1 and 2). The resulting hardening of the surface caused rejection of the strip.

The explanation of this trouble was to be found in the fact that pyrolysis of the hydrocarbons in the gas was occurring, causing a deposition of carbon on the walls of the muffle tube and carburizing the strip itself.

Wheeler and his co-workers have studied the pyrolysis of the hydrocarbons in some detail (*Fuel in Science and Practice*, 1928, 7, 535; 1929, 8, 512, 560). Earlier, in 1908, Bone and Coward had published an important paper on the thermal decomposition of methane, ethylene, ethane, and acetylene (*Journ.* Chem. Soc., 93, 1,197). Some of their conclusions are as follows:

(1) Methane is the most stable of the hydrocarbons considered and is always a principal product of the decomposition of the other three, especially above 800° C. It decomposes directly into carbon and hydrogen and the process is probably reversible at all temperatures and is chiefly a surface phenomenon.

$$CH_4 \rightleftharpoons C + 2H_2.$$

The carbon deposited from methane is of a peculiarly hard and lustrous type, wholly different from the dull soft variety yielded by the other three hydrocarbons studied, except in so far as the latter may arise as the result, in part, of the secondary decomposition of methane.

(2) The decomposition of ethane, ethylene, and acetylene is not chiefly a surface effect, but takes place throughout the body of the gas. Methane is always a principal decomposition product,

$$e.g.,\ C_2H_4 = C + CH_4.$$

Wheeler and Wood (*loc. cit.*, 1928, 7, 535) studied the decomposition of methane in iron tubes at 900° to 1,000° C. and found that the issuing gases were solely hydrogen and methane. The decomposition of methane in iron tubes is thus exclusively into its elements, carbon and hydrogen. On the other hand, when quartz tubes were used, no carbon was deposited but higher hydrocarbons such as benzene and naphthalene were produced.

The decomposition of the hydrocarbons present in town

Fig. 1.*
Cross-section through strip (0·09% C) photographed at a bend (× 50).

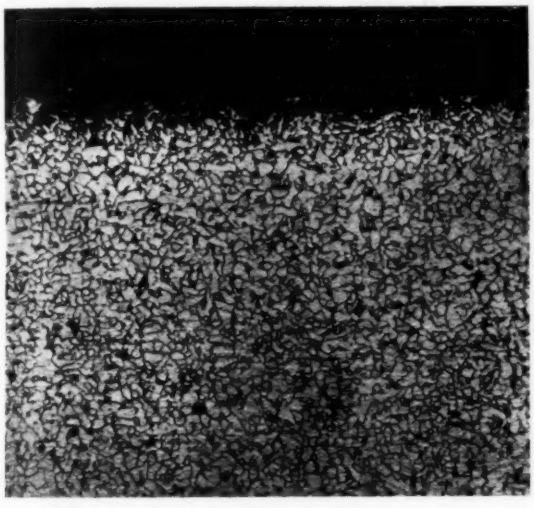


Fig. 2.
Cross-section through strip (0·09% C) (× 100).

Figs. 1 and 2 show surface carburization of steel normalized in town gas.

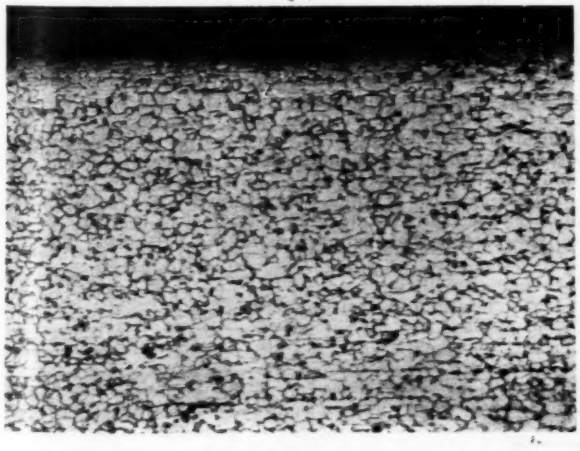


Fig. 3.
Cross-section through strip (0·10% C) (× 100). No surface alteration of surface of strip normalized in town gas after pyrolysis.

* Figs. 1, 2, and 3 are microphotographs of low carbon steel strip normalized by different methods. (In all cases the surface is below the black background.)

gas at high temperatures will result, therefore, in decomposition of carbon with the production of a carburizing atmosphere. The carbon is of two types—namely, the hard and the soft variety—the hard variety being presumably derived from the pyrolysis of methane and the soft variety from the pyrolysis of the unsaturated hydrocarbons. The logical solution of the difficulty is to pass the gas through a pre-heated tube, heated to the same temperature as the furnace itself, in order that carbon deposition will occur there, leaving a gas that will be " balanced " for the particular steel under treatment. The carbon content of the steel will decide the composition of the neutral atmosphere required, which will be in equilibrium with it, and this composition is achieved by passing the gas through the pre-heating tube at a rate which will result in this composition being established—*i.e.*, the rate of flow of gas is varied to suit the carbon content of the material.

This principle was applied to the solution of the problem at the works concerned and met with complete success (see fig. 3). In the first case a single steel tube, similar in length and diameter (1 ½ in.) to the three steel muffle tubes of the furnace, was placed side by side with the muffle tubes proper and the gas was led through this prior to being passed into the muffles.

This pre-heating tube could only be used for a period of about 48 hours with a rate of flow of gas of 30 c.ft. per hour, after which it was choked with carbon. Moreover, the position of this tube was inconvenient, the frequent removal which was necessary being tedious and difficult. Consideration was therefore given to the possibility of placing the pre-heating tube across the furnace in the hot zone just above the muffle tubes. This arrangement was helped by the fact that there already existed suitable sighting holes in the sides of the furnace through which the pre-heating tubes could be passed (see fig. 4).

Since the pyrolysis of methane in iron tubes is a surface phenomenon, it will be realized that the length of the pre-heating tube will be an important factor in ensuring that the gas will have a sufficient time of contact for a " balanced atmosphere " to be set up for maximum rates of flow. From observations on the extent of carbon deposition in the pre-heating tubes placed along the length of the furnace, it is possible to calculate what increase is necessary in the internal diameter of the tubes in order to compensate for the limitations of the length of the tube imposed by the shorter width of the furnace.

With a round tube of diameter d, and heated length L, and with a passage of Q volumes of gas per unit time, the time of contact of the gas with the walls of the tube will be proportional to:

(1) The length of time t that the gas is in the tube.
(2) The area A of the heated surface of the tube.

(1) The length of time t that the gas is in the tube is inversely proportional to the velocity of the gas, which in turn is proportional to the quantity of gas passing in unit time Q, and inversely proportional to the internal cross-sectional area of the tube; t is also directly proportional to the length of heated tube L.

i.e., t varies as $\frac{d^2L}{Q}$.

(2) The area of the heated surface of the tube is proportional to its diameter d and length L,

i.e., A varies as d . L.

Therefore, the time of contact varies as $\frac{d^3L^2}{Q}$.

In order that sufficient time and contact shall exist, it follows that $\frac{d^3L^2}{Q}$ shall not be less than some constant k—*i.e.*, for all cases

$$\frac{d^3L^2}{Q} < k$$

or, L is not less than $k_1\sqrt{\frac{Q}{d^3}}$.

It was found that with a maximum rate of 30 c.ft. per hour that carbon decomposition was complete over a length of 5·6 ft. heated surface in a tube of 1 ½ in. internal diameter.

$$\text{Hence } k_1 = L\sqrt{\frac{d^3}{Q}}; \quad 5{\cdot}6 \times \sqrt{\frac{13^3}{12^3 \times 30}} = 1{\cdot}17.$$

Hence, adding a 50% safety factor, we have for the minimum length of tube

$$L = 1{\cdot}75\sqrt{\frac{Q}{d^3}}$$

where L = length in feet of pre-heating tube.
Q = maximum gas rate in c.ft. per hour.
d = internal diameter of tube in inches.

The width of the furnace was 1·5 ft.

Application of the foregoing equation shows that a tube

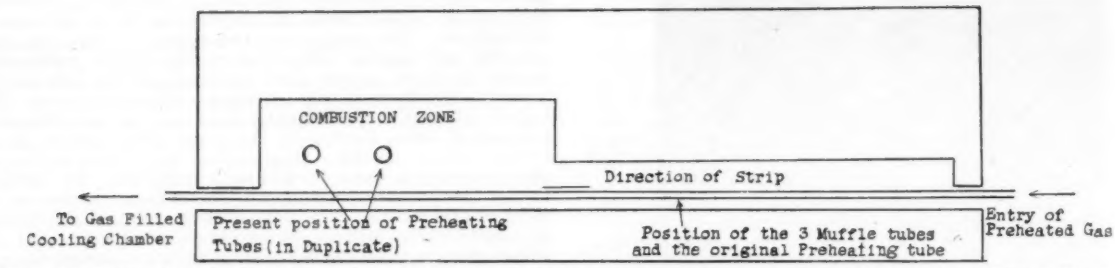

COMBUSTION ZONE
Direction of Strip
To Gas Filled Cooling Chamber
Present position of Preheating Tubes (in Duplicate)
Position of the 3 Muffle tubes and the original Preheating tube
Entry of Preheated Gas

FIG. 4.—DIAGRAM OF CONTINUOUS STRIP NORMALIZING FURNACE (GAS FIRED), SHOWING POSITION OF PREHEATING TUBES.

(Details of Combustion and Recuperation are omitted.)

with a 4 in. internal diameter would be suitable. It was thought advisable to fit duplicate tubes in order that one might be in use while the other was being cleaned out. Two 4-in. tubes were therefore placed across the furnace in the hot zone, together with gas taps and delivery pipes to the muffle tube, so arranged that one tube was working while the other was open for inspection and cleaning *in situ*. In order to increase the area of heated surface, the tubes were packed loosely with iron turnings. The process of cleaning simply consisted in opening the tube, pushing out the turnings with a ram, and re-charging with fresh turnings, an operation which is carried out once every 24 hours.

This furnace has now been in operation under these conditions for a period of 873 working hours. During this time the total amount of gas passing through each of the three muffles has been 8,440 c.ft. or 25,320 c.ft. for the three muffle tubes. The quantity of carbon deposit taken out in the same period was 2 oz. for the three muffle tubes. Hence, the pre-heated gas, after further heating in the muffle tubes proper, has deposited carbon to the extent of $\frac{2}{25{\cdot}32} =$ 0·079 oz. per 1,000 c.ft. It can be estimated from data available that prior to the introduction of pre-heating tubes, the carbon deposition was equal approximately to 13 oz. per 1,000 c.ft.—that is to say, the carbon deposition in the muffle tubes is now only 0·6% of what it was originally. It is possible that this small quantity of carbon owes its origin to carbon in a fine state of division which has been carried by the gas stream from the pre-heating tubes, and that it could be entirely prevented by the incorporation of a loose plug of asbestos placed in the gas circuit between the pre-heating tubes and the muffles.

Alterations in the Composition of Gas during its Passage through the Pre-heating Tube.

Gas samples have been taken before and after the pre-heating tubes. Analyses of these samples indicate the changes produced in the composition of the gas when heated to 980° C. for a rate of flow of 30 c.ft. per hour as follows:

	Gas Prior to Entering 4-In. Tube.	Gas After Exit from 4-In. Tube.
CO_2	2·00	1·55
O_2	1·58	0·00
C_nH_m	2·45	0·51
CO	7·60	10·48
CH_4	23·80	20·96
H_2	49·75	54·6
N_2	12·82	11·9

The points to be noted are:

(1) A reduction of the unsaturated hydrocarbons and the methane owing to such reactions as the following:

$$C_2H_4 = C + CH_4$$
$$CH_4 = C + 2H_2$$

With longer time of contact (*i.e.*, lower rates of flow) the unsaturated hydrocarbons completely disappear.

(2) An increase in the hydrogen content results owing to the reactions mentioned in (1).

(3) Oxygen completely disappears owing to such reactions as the following:

$$2H_2 + O_2 = 2H_2O$$
$$2C + O_2 = 2CO$$

(4) The CO_2-content is diminished owing to such reactions as the following:

$$CO_2 + H_2 \rightleftharpoons CO + H_2O$$
$$C + CO_2 \rightleftharpoons 2CO.$$

(5) The CO content is increased as the result of reactions (3) and (4).

Assuming these reactions, it can be calculated that 100 litres of gas would deposit 0·895 gramme of carbon for a change in analysis as shown above. This figure agrees sufficiently well with an average value of 0·815 gramme per 100 litres of gas obtained experimentally over a limited period under these conditions.

The Different Gas Compositions Required to Give a Neutral Furnace Atmosphere for Steels of Different Carbon Content.

While these experiments were being carried out on a practical scale, work of an investigatory nature was commenced in the laboratories of the Rotherham College of Technology. The object of these experiments was to determine:

(1) The effect of rate of flow of gas through pre-heating tubes on the final composition of the gas.
(2) The composition of the pre-heated gas which is in equilibrium with steels of varying carbon content.

A diagram of the apparatus used is shown in fig. 5. The pre-heating tube of length 150 cm. and internal diameter 2 cm. consisted of an ordinary piece of steel gas piping and was heated externally by an electric furnace over a length of 100 cm. Gas was passed into this through a meter, M. The exit end of the pre-heating tube was connected by a bend of brass tubing to a similar tube, B, length 76 cm., heated over a length of 33 cm. This latter tube, B, served as the muffle tube in which the specimens were heated. Both furnaces were maintained at a temperature of 880° C. throughout these experiments. The pre-heating tube A was packed loosely with mild-steel turnings. In view of the relative smallness of the apparatus and the possibility of finely-divided carbon being swept forward from the pre-heating tube into B, a loose plug of asbestos wool was placed in the inlet end of B. Screwed-in connections were used throughout and made gastight by the use of red lead and asbestos filling.

Effect of Rate of Flow.—In the first place, experiments were carried out to determine the effect of the rate of flow of the gas on the composition of the exit gas. The gas

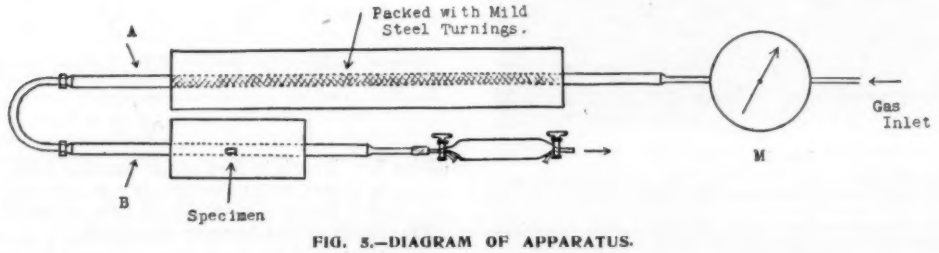


FIG. 5.—DIAGRAM OF APPARATUS.

samples were analysed in a Bone and Wheeler gas analysis apparatus. The results were as follows:

Constituent.	Composition of Original Gas.	Composition of Preheated Gas with Rates of Flow (Litres per Hour) of—		
		(I.) 38.	(II.) 11.	(III.) 4½.
CO_2	2·44	0·25	0·16	0·1
O_2	1·55	0·0	0·0	0·0
C_nH_m	2·73	0·0	0·0	0·0
CO	7·15	15·2	15·8	18·1
CH_4	27·95	18·5	8·55	2·68
H_2	47·00	55·2	65·9	68·6
N_2	11·13	10·85	9·59	10·52
	100·00	100·00	100·00	100·00

These variations in composition are plotted in fig. 6 for the constituents CH_4, H_2, CO.

Equilibrium Atmospheres for Steel of Various Carbon Contents.—The procedure in these experiments was to place

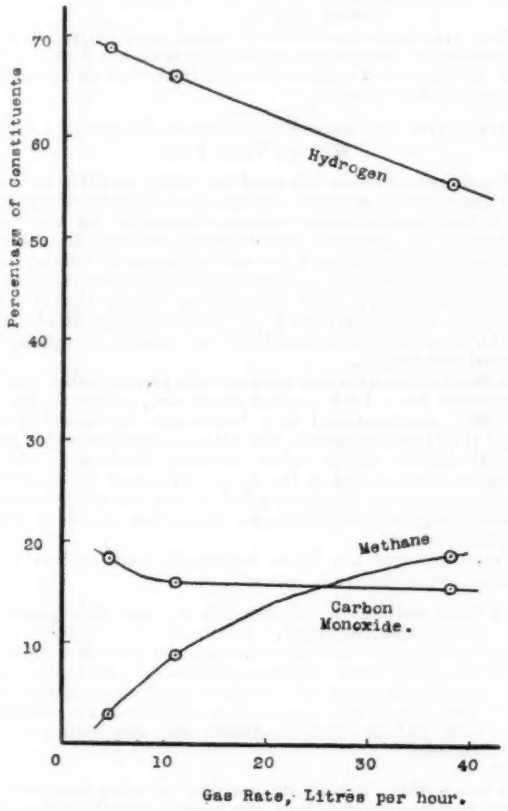


Fig. 6.—Variation of Composition of Town Gas After Passage Through Pre-Heater at Different Rates of Flow.

a sample of steel of known carbon content in the section B for a certain time at a temperature of 880° C. with a definite rate of gas passing through the apparatus. The exit gas was sampled during the experiment, and analysed if necessary.

In the first few experiments the sample was allowed to cool down (in an atmosphere of gas) by closing the exit end of the tube B at the end of the experiment. In the later experiments the sample, after having been heated, was pulled towards the cold end of the tube B by means of a piece of stiff wire, the gas stream being maintained during this operation. When cold, the sample was brought out of the gas atmosphere into the air. In all cases no trace of oxidation was observed, the sample being withdrawn as bright as it went in. In some cases, however, where the rate of gas flow had been considerable, there was a slight film of carbon deposit on the sample.

The samples consisted of about 1½ cm. lengths of bar steel of diameter 1·3 cm. These samples were sawn into two halves and one half was used in each experiment. After having been submitted to the gaseous atmosphere at a temperature of 880° C. for an observed time, the samples on cooling were sawn in two and this cross-sectional face was then polished and etched, and the edges examined under the microscope for evidence of carburization or decarburization. In some cases photographic records were taken.

It may be emphasized that it is rather difficult to adjust the composition of the atmosphere so as to give absolutely no trace of carburization or decarburization over prolonged periods of time. A slight deviation from the correct atmosphere in any particular case will give a cumulative effect when the time interval is considerable. In practice, the strip which is passing through a strip annealing furnace is only in the hot zone a short time, and under these conditions there will be a considerable latitude as regards gas composition before any carburization or decarburization occurs. With untreated gas, however, as used under present conditions, there is always a tendency toward heavy carburization, particularly with low carbon steels.

Experiments have been carried out with a low carbon steel (0·18% C.) and with a high carbon steel (0·9% C.).

It was found that with the 0·18% C. steel a neutral atmosphere was obtained when the gas was passed through the pre-heating tube of the apparatus at a rate of 6 litres per hour. It was deduced from the graph that this would result in a gas composition as follows:

CO_2	= 0·0
O_2	= 0·0
C_nH_m	= 0·0
CH_4	= 4·0
H_2	= 68·0
N_2	= 10·2

A micro-photograph of this specimen is shown in fig. 7.

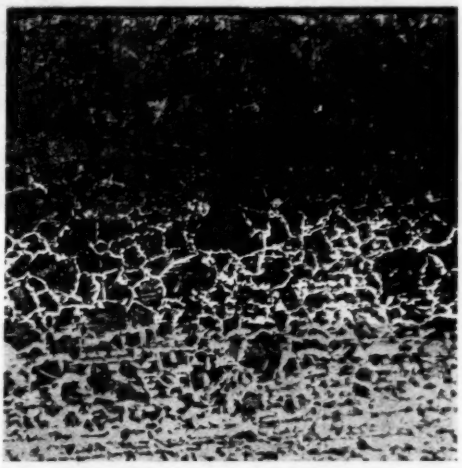


Fig. 7.*†
0·18 % C steel, surface carburized (× 38).

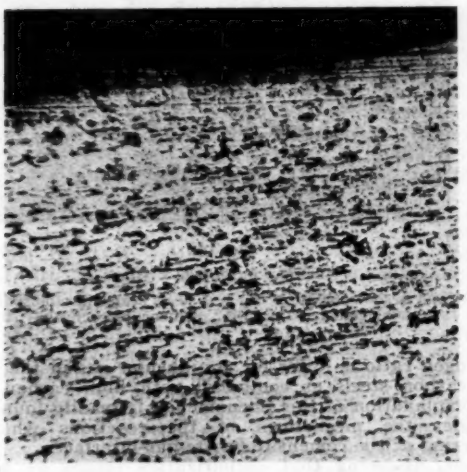


Fig. 8.
0·18 % C steel, surface unaltered (× 38).

* Figs. 7 and 8 show surface of 0·18% C steels heated in atmospheres containing 18 and 4% of methane, respectively.

† Figs. 7-10 are micro-photographs of the surface of steels of varying carbon content to show how the atmosphere must be altered to suit the carbon content to avoid carburization or decarburization.

A more rapid rate of flow resulted in a sample which was carburized (fig. 7; rate of flow = 18·5 litres per hour).

In the case of the 0·9% C. steel a neutral atmosphere was

obtained when the gas was passed through the pre-heating tube at a rate of 60 litres per hour, giving a gas composition as follows:

		%
CO_2	=	0·26
O_2	=	0·0
C_nH_m	=	0·0
CO	=	14·52
CH_4	=	18·45
H_2	=	55·80
N_2	=	10·97

A micro-photograph of this specimen is shown in fig. 10.

A slower rate of flow gave a specimen which was decarburized (see fig. 9; rate of flow = 12·5 litres per hour).

It is seen from these experiments that a much slower gas rate is required for the low carbon steel as compared with the high carbon steel. In other words, the methane/hydrogen ratio is lower for equilibrium gas in the case of low carbon steels as compared with high carbon steels. The explanation of this phenomenon is readily found if we consider the mechanism of the reactions which are occurring at the cementite-ferrite-gas interfaces.

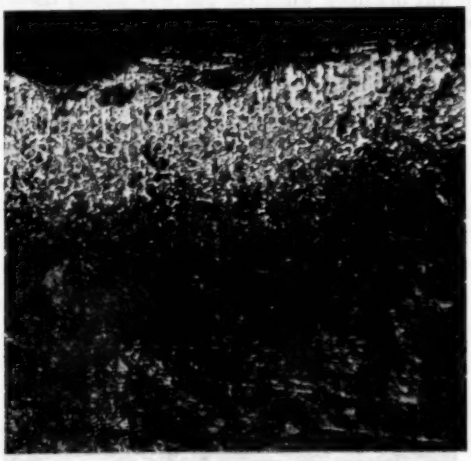


Fig. 9.*

Surface decarburization (× 38).

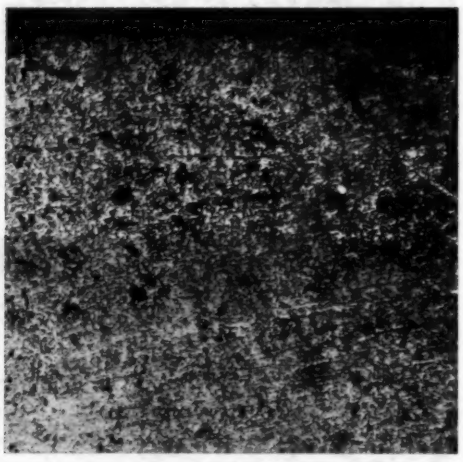


Fig. 10.

Surface unaltered (× 38).

* Figs. 9 and 10 show surface of 0·9 % C steels heated in atmospheres containing about 10 and 18% methane, respectively.

Thus, assuming that carburization occurs by reaction between the methane and the pure ferrite:

$$3\,Fe + CH_4 = Fe_3C + 2H_2 \quad \ldots\ldots (1)$$

whereas decarburization occurs by reaction between the hydrogen and cementite:

$$Fe_3C + 2H_2 = 3Fe + CH_4 \quad \ldots\ldots (2)$$

then for equilibrium to be established these opposite reactions must take place at the same rates, which we can express as follows:

$$3Fe + CH_4 \rightleftharpoons Fe_3C + 2H_2.$$

Application of physico-chemical principles will lead one to conclude that the rate of the first reaction will be proportional to (1) the methane concentration, and (2) the available surface area of pure ferrite, whereas the rate of the second reaction will be proportional to (1) the square of the hydrogen concentration, and (2) the available surface area of cementite. Therefore, at equilibrium the ratio:

$$\frac{(CH_2)^2 \times \text{Area } Fe_3C}{(C_{CH4}) \times \text{Area}_{Fe}} = \text{a constant K.}$$

It can be calculated that the percentage areas of cementite and ferrite for the two carbon contents considered are as follows:

Carbon Content. %		Surface Areas. 1. Fe_3C. %		2. Fe. %
0·18	..	3·77	..	96·23
0·9	..	18·07	..	81·93

Applying the foregoing equation, we have:

(1) For a 0·18% carbon steel, where the equilibrium gas contains 68·0% H_2 and 4·0% CH_4,

$$\frac{68 \times 68 \times 3{\cdot}77}{4 \times 96{\cdot}23} = 45{\cdot}3$$

(2) For a 0·9% carbon steel, where the equilibrium gas contains 55·8% H_2 and 18·45% CH_4,

$$\frac{55{\cdot}8 \times 55{\cdot}8 \times 18{\cdot}07}{18{\cdot}45 \times 81{\cdot}93} = 37{\cdot}3.$$

The agreement is sufficiently good considering that the composition of the gas in equilibrium with the 0·18% carbon steel was not determined directly but was deduced from the rate of flow of gas.

Application of these Principles to Furnaces of the Muffle Tube Type.

It is suggested that pre-heating tubes be fitted to muffle tube furnaces, in general, on the lines already described in order that troublesome carbon deposition in the muffle tubes may be avoided, and that gas of any desired composition may be obtained for use in the muffle tubes proper. A small gas meter is a desirable auxiliary to regulate the rate of gas flow. The pre-heating tubes should be in duplicate and constructed of heat-resisting steel. They should be so designed that they can readily be opened and cleaned out *in situ*.

In connection with the preparation of an equilibrium gas to be used for a high carbon steel—*i.e.*, a gas containing, say, 20% methane and 55% hydrogen—the question may arise, Will further carbon deposition occur from this gas in the subsequent muffle tubes, causing blockage? The experiments carried out in the laboratory, and the large-scale experiment which has been tried out on the strip annealing furnace, suggest that if carbon deposition occurs it will be extremely slight.

These experiments have indicated that carbon is deposited in two different ways:

(1) Free carbon is deposited first, and this process is comparatively rapid.
(2) Subsequent deposition occurs not as free carbon but through direct carburization—*i.e.*, the formation of cementite, and this process is slow compared with (1). That is to say, it is possible to have carburization taking place without the deposition of free carbon.

In cases where a high carbon steel is being annealed and where the gas composition has been correctly adjusted, it follows *a priori* that deposition of the second type does not take place. Furthermore, steel muffle tubes will quickly become carburized on the surface and will subsequently resist any further action of gases which contain a relatively high methane content.

It was considered that the principle of adjusting the composition of a gas by pyrogenic decomposition was capable of wider application and to this end a muffle furnace fitted with pre-heating tubes has been constructed by Messrs. G. P. Wincott, Ltd., for the purposes of further experiments. Unfortunately this furnace has only just been erected, and I am therefore unable to give any further results at the moment.

The furnace is fitted with a muffle chamber 1 ft. 6 in. in length, 1 ft. in width, and 9 in. in height. There are two pre-heating tubes of heat-resisting steel arranged above the muffle chamber from back to front of the furnace. The gas to be treated passes through these tubes and enters the muffle chamber at the back. This furnace will consume about 600 c.ft. of gas per hour.

In conclusion, the examples that I have mentioned are typical of the problems that must face every undertaking of any size which is supplying gas for industrial processes. In Rotherham, where conditions are favourable for the use of gas in industry, 57% of our total output of 1,000 million c.ft. per annum being industrial gas, and this figure is constantly increasing. The firm at which the continuous strip normalizing furnace is in operation use 50 million c.ft. per

annum and are about to extend their load to 150 million c.ft. per annum. Two of our customers are already taking loads of the latter order.

With the many processes in which gas is being used there is always the possibility of problems of this type being put to the gas undertaking. Such problems require special resources and not every undertaking is able to find these resources. It is for this reason that the Development Centres should be ready to provide adequate laboratories where such problems can be tackled.

It has been proved over and over again that those concerns which are equipped for organized inquiry and research eventually succeed where others fail. The Gas Industry is no exception to this rule, and at the present time there are splendid opportunities in the industrial field. Success or otherwise depends entirely upon the Gas Industry itself.

Discussion.

Mr. J. T. HAYNES, Engineer and General Manager to Rotherham Gas Department, said it would be realized by all present that at Rotherham they were doing work which was beyond ordinary routine. He would like to express his appreciation of the work that Dr. Heathcoat was doing.

Mr. F. C. CLARKE (Principal of the College of Technology, Rotherham) welcomed the members of the Association to that institution. In his opinion a technical college did not exist merely to impart knowledge to those who had neglected their earlier education, although they attempted to teach physics, chemistry, mathematics, and the applied sciences to those who were lacking in these subjects. The highest function of a technical college was to co-operate with the local industries and to assist in working out their problems. At Rotherham they were co-operating in every possible way with the Gas Department.

Mr. J. W. WOOD, M.Sc. (Leeds), expressed his appreciation of the paper that had been given by Dr. Heathcoat. Some years ago he had been engaged on work the object of which was to achieve exactly the opposite of that described in the paper—*i.e.*, he was investigating the possibility of carburizing in an atmosphere of town gas. There were two points that he would like to raise. First, did Dr. Heathcoat consider that he had achieved genuine equilibrium in the cases considered? Secondly, there was the question of the effect of carbon monoxide. In earlier work which had been carried out with methane-hydrogen mixtures some of the discrepancies between the results of different workers were explained by the fact that the gases employed were impure.

Mr. PREECE (Leeds University) asked how Dr. Heathcoat had calculated the surface areas of ferrite and cementite. He pointed out that the cementite would be in solution at the temperatures employed.

Mr. H. J. HODSMAN, M.Sc. (Leeds University), asked for further information as to the rate of decomposition of the hydrocarbons and whether true equilibrium would involve no further carbon deposition.

THE AUTHOR'S REPLY.

Dr. HEATHCOAT, replying to the discussion, said he considered that true equilibrium had been reached in the case of the experiments carried out in the laboratory. With regard to the furnace that was in operation at the works, he would not claim that the exact equilibrium gas was maintained throughout. It was not necessary in this case to obtain exact equilibrium, since the strip was in the hot zone only for a matter of two or three minutes, and during this short time variations from the true equilibrium gas would not have any effect on the strip. With raw gas, however, which had not been subjected to pyrogenic decomposition, the initial deposition of carbon was so rapid that carburization of the strip occurred and the muffle tubes became rapidly blocked with carbon. He had not considered the effect of carbon monoxide in detail. The method of Schultz and Hulsbruch demanded pure supplies of methane and hydrogen, which were impracticable under works conditions. He was attempting to produce a neutral atmosphere by treating commercial gas, such as town gas. The effect of carbon monoxide would have to be considered with reference to the methane and hydrogen present in any theoretical treatment of the subject, but he considered that the effect of this gas was secondary in importance to that of the main constituents, hydrogen and methane.

Referring to the remarks of Mr. Preece, Dr. Heathcoat said he had calculated first the volume concentrations of cementite and ferrite knowing the weight concentrations and utilizing the values available for the densities of ferrite (7·8) and cementite (5·5). It was then possible to work out the surface concentrations of cementite and ferrite, assuming that the cementite was dispersed in a fine state of division throughout the ferrite. This calculation, of course, made certain assumptions which were imposed by the lack of information as to the variations in the densities of cementite and ferrite at high temperatures.

Replying to Mr. Hodsman, Dr. Heathcoat said the initial decomposition of the hydrocarbons was rapid—particularly in the case of the unsaturated hydrocarbons. Subsequent decomposition was slower. At equilibrium the rates of the forward and back reaction were equal. Chemical equilibrium was always dynamic, not static. In effect, carbon was not deposited if true equilibrium was reached.

Carbonization of Somerset Coals*

By S. HOLE, of the Bath Gas Company.

The importance of clean coal to the Gas Industry has been emphasized time and again, and rightly so. Clean graded coke of a good quality is becoming more and more general, and is more than holding its own in competition with high-grade anthracite for slow combustion purposes. In Bath we have built up a very important local demand for clean graded coke. This demand has now reached considerable proportions and totals a high percentage of our coke sales. In January of this year we were supplying graded coke for hot water boilers and plant of a similar type at the rate of over 100 tons per day. This coke has an ash content of a little over 12%, is as free from bats as possible, and on average does not contain more than 1·5% of moisture.

In order that the quality should be as even as possible, constant supervision of the coal received from pit is maintained. For a number of years after the war period the ash content of our Somerset coals was high, ranging from 12% to 23%, the average approximating to 18%. The importance of a clean grade of coal was continually pressed home upon the Somerset Collieries who supply the bulk of our coal. In 1928 a mutually agreed datum line of 10-11% ash was fixed with a penalty clause for all above 11% and a refund of a similar amount for all below 10%. This scheme worked very well for several years, the Collieries making every effort to keep foreign matter down to a low figure. These efforts and constant watchfulness at our end have resulted in a further adjustment of the sliding scale and a lowering of the datum to 9-10%. It is realized that it will not be possible to go much lower with the datum line, unless the individual coals are specially treated in washing or dry cleaning plants. The Somerset coal seams are of such a character that an inherent ash of 6-7% is expected on straight coal from the seam, and it is difficult to avoid bands of foreign matter in the actual lump coal.

We have found that the coke consumer rarely complains of the inherent ash in his fuel. Complaints are, however, received if the coke contains bats and shale pieces, perhaps because they are so obvious.

All coal wagons received at the works are inspected before tipping, and doubtful ones are held up for careful examination. On several occasions serious trouble has been forestalled.

One of our members, Mr. Arthur Marsden, presented in a paper (see "JOURNAL" for April 25, 1928, p. 248) observations on the distribution of ash in coal and coke which form a very valuable addition to our knowledge of coal. A considerable amount of check work on the lines described by Mr. Marsden has been carried out.

I mentioned earlier that we supply a fuel with low moisture content. The coke discharged from the retorts is handled by D.B. conveyors. The conveyor trough is fitted with automatic quenchers which come into operation when there is a full load of coke in the conveyor. A quantity of incandescent coke, therefore, passes without causing the paddles controlling the water quenching to come into operation. This coke is steam quenched in its subsequent travel outside the retort house either on its way to the hoppers or in the hoppers themselves.

The heat in this coke is sufficient to dry off the quenched coke. It may be thought that such methods would be liable to give rise to fire in the storage hoppers, but such has not been the case. While many coke consumers find they achieve better results from a damped fuel, from our point of view it is better to supply a dry coke. The supply of fuel with a high percentage of water does not seem good policy to me. If the consumer wishes to wet his fuel before use he has at least the satisfaction of knowing he has received practically 100% dry fuel.

COAL TESTING AT BATH.

The testing of coals in Bath is generally carried out on a large scale, using the works carbonizing plant as a whole

* From the Presidential Address to the Western Junior Gas Association Meeting at Bath, April 14, 1934.

for this purpose. This necessitates some 500 tons for test purposes, part of which is used for sweeping out charges, and approximately 250 tons, a full day's supply, for a 24-hour test. This tonnage is reserved from current consignments without notification to colliery, and consequently is representative of deliveries.

From these full-scale tests a comprehensive idea of the valuation of the coals is obtained. The same methods are employed with coals which are offered for contract. Table 1 gives the full data obtained from such scale tests. Unfortunately, as the whole of the tar and liquor made is collected and stored in the same well, and the size of the well is such that accuracy of measurement to a close figure is impossible, reliable figures for tar and ammonia liquor production are not available.

TABLE I.—*Works Scale Coal Tests (24-Hour Run).*

Data.	A.	B.	C.	D.	E.	F.
Coal carbonized	121·55	230·0	236·1	231·0	235·5	238·6
Gas made, c.ft.	1,548,325	3,059,000	3,317,000	3,206,000	3,320,000	3,174,000
Gas made per ton	12,738	13,300	14,049	13,878	14,097	13,302
Calorific value	533	501	511	510	512	504
Therms per ton	67·89	66·63	71·79	70·77	72·12	67·04
Coke for sale, tons	73·64	156·75	144·45	140·0	135·45	149·75
Coke, cwt. per ton of coal	13·4	13·70	12·23	12·12	11·46	12·13
Large coke, %	21·31	32·41	33·27	34·32	29·59	30·35
Cut coke, Grade B, %	23·68	32·12	29·44	28·71	26·24	28·21
Cut coke, Grade A, %	21·93	14·73	16·77	16·07	20·11	17·23
Breeze, %	23·08	20·74	18·52	20·89	24·02	23·30
Coal analysis—						
Ash, %	9·72	7·80	8·44	10·31	5·03	9·01
Volatile matter, %	29·10	27·98	31·75	30·48	34·16	29·48
Moisture, %	0·92	0·40	1·50	1·33	3·40	1·05
Sulphur, %	1·53	1·34	1·63	1·40	0·94	1·74
Crude gas, grains per 100 c.ft. at inlet to Livesey washers—						
Ammonia	169·6	150·2	169·9	172·4	180·3	172·5
Sulphuretted hydrogen	214·2	176·3	150	162·9	142·9	161·9
Naphthalene	14·30	15·21	12·34	13·14	15·28	15·33

In order that tests of a comparative nature may be made, a Gray-King coal assay apparatus is installed in the laboratory. This apparatus can be used for low and high temperature work and has furnished a quantity of interesting data.

It is our practice to sample and test individual coals at least twice a week. The work carried out upon these samples consists of:

(*a*) Proximate analysis of coal and coke.
(*b*) Examination of ash for principal constituents.
(*c*) Low-temperature assay of the coals and analysis of residuals and gas produced.
(*d*) High-temperature assay of the coals and analysis of residuals and gas produced.

The methods used are described in the Fuel Research Technical Papers Nos. 7, 21, and 24.

While carrying out a few preliminary tests it was found that the full weight of coal recommended—viz., 20 grammes—was difficult to manipulate as the charge appeared to burst as the temperature of the furnace was raised. This gave rise to a sudden release of gas of sufficient pressure to blow the manometer gauge.

To overcome this the individual coals, before the retort was charged, were mixed with varying percentages of dried powdered coke.

The temperature range on the low-temperature assay was 300°-600° C., and on the high-temperature assay, 300° to 900° C., with the cracking chamber maintained at 800° C. throughout the test. The cokes obtained from the low-temperature assay were very soft and pliable, and had a glossy surface.

The high-temperature cokes were dull in appearance and quite hard.

It must be remembered when comparing the high-temperature results with those obtained from the works scale tests previously enumerated that the horizontal retort temperature is at least 100° higher. The tar results obtained are low, but are comparative and therefore of use. Gas coke and liquor figures are more closely related to working practice, bearing in mind the point already mentioned.

The analysis of gases produced are of considerable interest and give figures which vary from those expected. This is especially so in the case of unsaturated hydrocarbons. The analysis of ash obtained from the coals is of interest giving relative composition of the fusible constituents.

COAL CARBONIZATION AND RETORT HOUSE TESTS.

The coal carbonization plant at Bath consists of two retort houses of horizontals having respectively 17 settings of eights 22 in. by 16 in. by 20 ft. worked by one operation charging machine, and 14 settings of tens, 24 in. by 18 in. by 23 ft. These retorts are charged and discharged by Drakes machine. The normal weight of charge in the former is 9 cwt. with 8-hour carbonizing periods, and 17·5 cwt. for a 12-hour carbonizing period in the latter. There is, therefore, apart from the difference in type of setting, a considerable difference in operation, and a variation in production results is to be expected. These differences briefly enumerated are:

(1) Quantity of gas produced per ton of mixed Somerset coal.
(2) Quality of gas produced.
(3) Quality of coke produced.
(4) Quality of tar produced.

As the two retort houses carbonize the same mixed coals, the various results obtained may be of more than passing interest. Unfortunately, the gas production cannot be measured separately, as the foul mains link up prior to the condensers. Full information of the working of the houses as separate units is available, as well as the combined results. From these we find that, when working the settings of tens as a separate unit, the maximum output is 14,200 c.ft. per ton of coal carbonized, with a C.V. of 505 B.Th.U. per c.ft.

The settings of eights give an average output of 12,300 c.ft. per ton of coal carbonized, of 510 B.Th.U. per c.ft.

From these figures, it will readily be seen that there are considerable variations under Heading 1.

QUALITY OF GAS PRODUCED.

The following total analyses, averages of a large number of test samples, illustrate clearly the variations found in the coal gas itself:

—	Settings of Eights.	Settings of Tens.
CO_2	4·10	3·80
O_2	0·50	0·50
C_nH_m	2·62	2·50
CO	7·10	7·35
H_2	39·52	45·16
CH_4	30·74	28·02
N_2	15·42	13·67
C.V.	513	507

Several factors determine this variation, the major ones being weight of charge, period of charge, and difference in retort temperature.

A series of experiments to ascertain what is actually happening in the retort and the variations of gas quality through the period of a 12-hour charge of mixed Somerset coals and individual coals has been made.

Samples of gas from the dip pipes on the charging and discharging of an individual retort have been taken at 15-minute intervals from the charging time to completion of carbonization. These samples were tested for calorific value and simple analysis—*i.e.*, carbon dioxide, unsaturated hydrocarbons, oxygen, and carbon monoxide. Time and the number of samples did not permit of further analysis. The rapid estimation of calorific values has been made possible by the use of the Charles Gray "Burna" gas calorimeter. This little instrument was brought to my notice by the patentee in December last, who demonstrated the adaptability of his instrument on coal gas, C.W. gas, and city gas. The points which appealed to me were the cheapness compared with other portable calorimeters, simplicity of use, and the high degree of accuracy

obtainable. There seemed to me to be a distinct field of usefulness for this little apparatus as a quick simple type of calorimeter, requiring little skilled attention, robust in construction, and easily checked. Such an instrument could be applied to many little problems arising in a retort house or coal gas plant, where reliable and quickly obtained information would be of value.

The instrument has been described in the Technical Press —see "JOURNAL" for Feb. 28, 1934, p. 556. It is extremely simple in construction, consisting of a U pressure gauge and bunsen burner linked up to the same source of supply. The main principles underlying its use are the supply of gas to the burner at a known and constant pressure, and control of the air used to consume this gas until slight over-aeration takes place, when the flame shows the normal tendency to pop at the mouth of the burner. The calorific value, when this point is reached, is read off on an adjustable calibrated disc. The whole operation takes a few seconds only to complete.

The instrument as supplied is graduated with a zero for coal gas. Zero for other gases can be easily and accurately determined by reference to a standard calorimeter on the appropriate stream of gas upon which it is intended to make observations. The claim of an accuracy to 1% was found after stringent tests to be a justifiable one.

The gas samples for testing purposes in the retort house were obtained from the connections on the dip pipes by a simple system of aspirators fitted with thermometers in order that testing should be maintained at a definite temperature throughout. The gas sample was supplied to the calorimeter at a standard pressure of 2 in.

Retort temperatures were maintained at a uniform level and condition of pull was stabilized, so that the results found with individual coals and mixed coals would be comparable.

Coke Production and Quality.

While the actual quantity of coke produced per ton of coal carbonized does not show a marked variation, there is a distinct difference in the quality of the coke from the two different retort houses.

—	Settings of Eights.	Settings of Tens.
Moisture	2·34	1·62
Volatile matter	1·98	1·03
Sp. gr.	1·612	1·676

Quality of Tar.

A considerable number of samples of tar from the collecting tower attached to the hydraulic mains have been taken. These samples are separately classified according to the position of the hydraulic main on the charging or discharging side of the retort bench.

Distillation figures obtained from these individual samples are given in Table 2. It will be noticed that there is a distinct difference between the tar obtained on charging and discharging sides of the settings of tens and similar samples from the settings of eights. It will also be noted that tar from the latter gives a higher percentage of light oils than from the former, although the subsequent fractions are smaller in quantity.

Table 2.

Data.	Settings of Eigths.		Settings of Tens.	
	Charging Side Hydraulic.	Discharging Side Hydraulic.	Charging Side Hydraulic.	Discharging Side Hydraulic.
Water	6·0	5·1	8·10	11·40
Dry Time.	%	%	%	%
0– 80° C.	0·02	0·42	0·01	0·01
80–100° ,,	0·12	0·16	0·02	0·05
100–120° ,,	0·15	0·23	0·01	0·06
120–140° ,,	0·03	0·12	0·02	0·04
	0·37	1·04	0·12	0·20
140–170° ,,	0·05	0·11	0·06	0·10
170–230° ,,	1·91	3·22	2·07	4·28
230–270° ,,	7·59	8·69	10·00	12·13
270–300° ,,	5·20	4·78	4·57	15·57
	22·82	25·48	38·46	43·67
300–350° ,,	7·75	7·38	11·80	11·23
Sp. gr.	1·23	1·188	1·194	1·180
$C_{10}H_8$	5·32	5·47	5·06	5·09
Free carbon.	17·45	13·10	7·54	10·93
Ash in tar	0·055	0·071	0·295	0·121

The varying percentages of so-called free carbon and ash present in these samples are of interest and will be dealt with later.

In the settings of tens it is the normal practice to leave a wad of coke on the mouthpiece at the discharge end of the retorts. This coke acts as a stop during charging operations with the Drakes machine. Condensate in the ascension pipe on the discharge side is absorbed by the wad, and during firedraws this material is carefully by-passed, as it obviously contains a much higher percentage of volatile matter than the normal discharged coke from the retort.

The temperature conditions existing in the dip pipe system throughout the charging period have been recorded. The ascension pipe temperatures through the bulk of the carbonizing period are much lower with the wad on the mouthpiece.

Coal Gas and Carburetted Water Gas.

There is a considerable field of usefulness on the carburetted water gas plant for the C.G. "Burna" calorimeter. I have noticed, using standard Boys and Junker calorimeters upon the C.W. gas stream at the purifier outlet, a considerable variation of quality in the gas produced, although the oil consumption has been stable throughout. In part, this variation is to be expected, as conditions in the generator are continually altering with varying depths of fuel and the condition of the fuel upon the fire bars—all affecting steaming to varying degrees.

A large number of tests have been made on gases at the top of the superheater, and, as far as possible, upon every other run. Time did not permit of the manipulation being completed so that every run could be tested. The variations of calorific value are certainly surprising.

The whole of the oil used for naphthalene washing is used upon the C.W. gas plant. A higher gallonage is used when working naphthalene wash oil. We have found by experience that, to get the same enrichment or calorific effect of cracking, this is consistently the case.

Condensation on the Coal Gas Plant.

The condenser units on the coal gas stream consist of two Dempster multi-tubular units of 1·6 million c.ft. capacity per day and a Holmes multi-tubular condenser of 3 million c.ft. capacity and a rated efficiency of 20 gallons of water per 1,000 c.ft. with a temperature fall from 120° to 60° F. The water feed to these units is from an overhead storage tank fed from the River Avon. For a number of years the water control was by hand valve operated by the exhauster engine room attendant, alterations of flow depending upon the usual readings of thermometers placed on the outlet gas connections. Such a method gave rise to considerable variations of outlet temperature, excessive water consumption over time periods, as would be naturally expected, the checking of gas outlet temperature being of necessity intermittent.

While the water supply was plentiful and the only charges those of steam and pumping, yet it was felt that better results could be obtained and a steady outlet temperature maintained if some other system of control was adopted. The instrument adopted to achieve this result was the Drayton A.M. relay type temperature regulator.

The general construction of this regulator can be readily followed from the line diagram, and its application from the photograph of the unit *in situ*.

Briefly the apparatus (fig. 1) consists of (1) a thermostatic expansion stem in two parts. An outer copper tube is attached to the castings (2) inside the tube, and fastened to its free end is a rod of non-expanding steel (3). An adjustment nut (4) is attached to the other end of rod (3) and acts upon the operating valve (5) which is at (6) and carries at its extremity a pilot valve closing at (7). This valve works against the spring (17). Variations of temperature acting upon the copper sheath (1) cause it to expand or contract, and this movement is conveyed to the arm (5) causing it to open or close the pilot valve (8). A stream of water at a constant pressure obtained through reducing valve (9) enters the regulator at (10) and passes the restricted opening (11). While the pilot valve is open more water escapes through (8) and will pass the restriction at (11) and no pressure is transmitted to the diaphragm chamber through pipe (12). As the pilot valve closes down due to fall in temperature conditions on the gas outlet of the condensers, with a consequent contraction of the copper sheath, the full static pressure will build up in the diaphragm chamber and gradually close the valve (15) against the action of spring (16).

With temperature rises on the gas outlet of the condenser, the reverse action takes place, and the pilot valve at (7) opens, due to the expansion of the copper sheath (1) reacting upon the arm (5), and the pressure acting upon the diaphragm (13) is reduced. The spring (16) coming into operation causes the valve (15) to open.

Adjustment of the controller is affected by turning nut (4) up or down rod (3), so causing it to engage with lever (5) at a higher or lower temperature. Turning nut clockwise will lower the temperature, and an anti-clockwise

movement will raise the temperature at which the regulator is set.

The thermostatic expansion stem of the regulator having a length of 15⅝ in. requires a main of 16 in. minimum diameter.

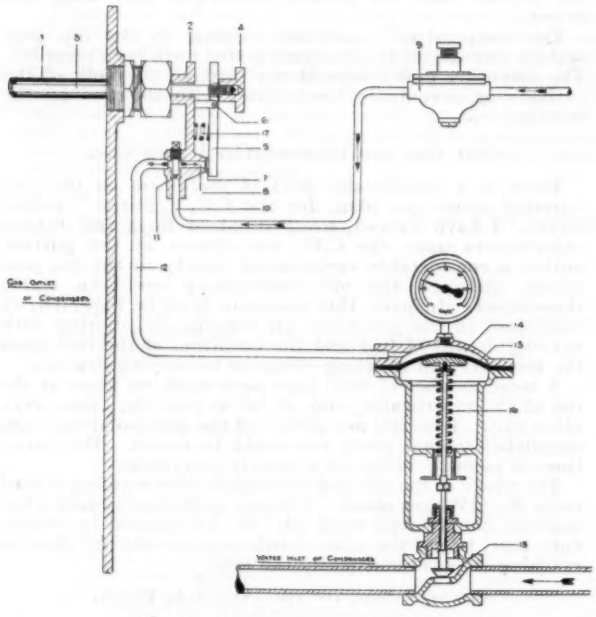


Fig. 1.—The Drayton A.M. Regulator.

The control having once been fitted to the gas and water system of the condenser and the temperature required in the gas outlet main decided upon, adjustment of the control quickly gives the required temperature conditions; and providing the water supply to the instrument is maintained at the correct pressure, such temperature conditions will be maintained. Drayton regulators are fitted to the Dempster and Holmes condensing units and have been in operation for two years with very satisfactory results, and it is fair to assume a considerable saving of water used. The outlet temperature is maintained at a steady figure. The gas outlet temperature on the condensers is naturally governed by the temperature of the cooling water supplied. In summer time the Avon water temperature may rise to approximately 70° F., as was the case in 1933. The conditions maintained on the condenser gas outlet will therefore of necessity be variable from this cause. The conditions aimed at are winter temperatures of 60° F., summer 60°-70° F., depending upon the cooling water temperature.

Variations of temperature of the gas at the inlet to the condenser are not excessive, and the average temperature of the gas during the winter is 120°-130° F. During the summer this temperature is practically the same, as there is a smaller volume of gas travelling through the foul main which probably counteracts any variation due to sun and atmospheric temperature.

Up to date, beyond occasional attention to pilot and water valves, which would be expected, the instruments have given perfect satisfaction and required little attention or adjustment. So satisfactory were these regulators that their installation on the condensers of the C.W. gas was decided upon. The conditions to be controlled on this plant are considerably more exacting than those on the coal gas condensers. First, we have the gas entering the condensers after a short passage through the washer at a much higher temperature. This is especially so since the adoption of the back-run process. Secondly, the condensers are under capacity. Thirdly, the two C.W. gas sets are often, during the winter time, working together on one or more shifts per day. Notwithstanding these difficulties, the instruments work very well, and give a straight line on the outlet of the condensers.

A large amount of the oil used in the C.W. gas plant comes direct from the naphthalene washers. A high percentage of the naphthalene contained in this oil passes through the plant uncracked in the carburettor and superheater, and with fluctuating temperature conditions gave rise to naphthalene stoppages and tar solidification on the flow pipes from the condensers to the separators. This trouble has been overcome by the installation of the Drayton regulator and the maintenance of a level outlet temperature.

Tar Emulsion.

In common with the majority of gas undertakings, during the condensation of coal gas and the liquefaction of tar vapours we produce a small amount of tar emulsion. This emulsion presents one or two points of interest.

Tar emulsions are generally produced by the condensation of water vapour and tar together, and consist of nuclei of free carbon or water with a coating of tar, or *vice versa*. In our particular case a fourth element enters into the constitution—namely, microscopic specks of mineral dust.

Some time ago we had occasion to inspect the tubes of our Holmes super-condenser, and we found these coated with a thick tar, which gave on examination the following analysis:

	%
Water	35·6
Free carbon	7·2
Mineral matter	0·59

This mineral matter proved on examination to consist wholly of iron dust.

In our well, where tar and liquor are stored together, the emulsion floats above the tar in the first foot of liquor and makes the pumping of the last foot or eighteen inches of liquor a matter of difficulty, as the emulsion rises to the pump suction.

An analysis of a typical sample follows:

Water by distillation	81·0 %	..	Dry basis
Free carbon	5·29 ,,	..	27·84%
Mineral matter (all Fe)	0·283,,	..	1·49,,

The sample gave a water separation on standing of 3% after 24 hours.

6% after 5 days at . . . . 100° F.
7 ,, ,, 48 ,, ... 100° F.

It will be noted that time has a small effect upon separation. A considerable number of mechanical methods have been tried to effect a separation, and the only plant which gave any indications of a reduction was a Sharples tar extractor.

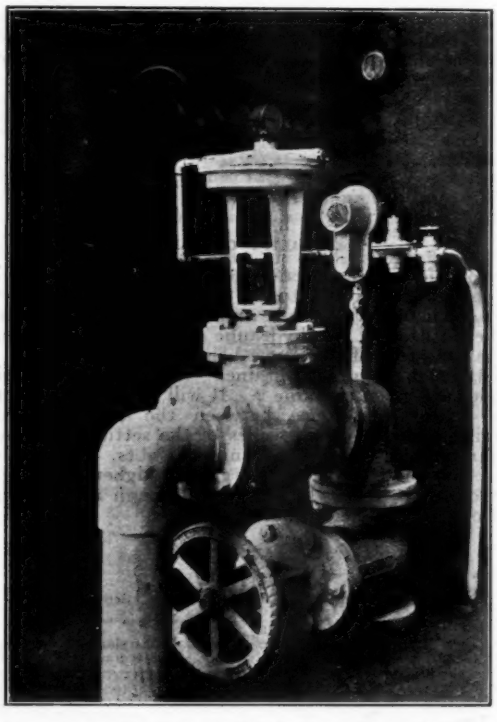


Fig. 2.—A Drayton A.M. Regulator at the Bath Gas-Works.

The method we employ is to pump the emulsion through the coal still of our Wilton tar plant until suitable conditions of temperature and pressure effect a partial dehydration. By this method the water content is reduced 50%-70%, and a final re-pumping through the plant effects a complete dehydration.

The method has to be carefully watched, as there is a liability to weaken the joints of the coil still through pockets of water and steam.

It would appear that minute iron dust present in the emulsion has a considerable effect upon the stubbornness of our particular type of separation. Another point of interest is the possible connection between the dust present and a projector type of coal charging machine in the retort house. It will be noted that with a conveyor type machine the dust is not present to the same degree. I shall be most interested to hear if any other members have come across the same problem and have their opinions on the matter.

Colombo Gas and Water Company, Ltd.

The Annual General Meeting of the Company was held at 148, Gresham House, Old Broad Street, E.C., on Monday, April 23—Mr. ROBERT H. GLEN, F.C.A. (Chairman), presiding.

The SECRETARY (Mr. S. F. Field) read the notice convening the Meeting and the Auditor's Report.

The CHAIRMAN: Gentlemen, when I had the pleasure of addressing you last year, I referred to the very difficult year the Company had had to contend with. Similar conditions have, unfortunately, prevailed in Ceylon during the year under review. Of the three staple industries of the Colony, only Tea brightened—under the artificial stimulus of a restriction of Exports. Rubber prices sagged to record low levels, although towards the end of the year a marked recovery was made on rumours of restriction. The Coconut Industry plunged into deepest depression as the India demand slackened off.

Now I will deal with the Accounts as before the Meeting and as regards the Capital Account I need only refer to the small item for Additions to Capital amounting to £496 1s. 8d., which is principally for Mainlaying Work.

The total Gas sold during the year was 251,968,600 cubic feet, as compared with 261,986,500 cubic feet for the previous year.

Eight hundred and twenty tons less Coal was carbonized, the cost per ton being slightly lower than for year 1932, the Gas made per ton of Coal carbonized being about the same as in the previous year.

The Gas unaccounted for was 6·34 per cent. as compared with 7·08 per cent.

Working Expenses are Rs. 267,322.08, as compared with Rs. 287,361.65. Wages are less; also, the amounts for maintenance of Works, Plant and Mains are lower than the preceding year. I should like to here mention that, although the trade in Ceylon is in a very depressed condition, no reductions in the Staff Salaries have been made.

Wages for Fitting Work is about the same as for year 1932.

Legal Expenses and Bad Debts Accounts are lower, especially the latter, the figure for Bad Debts being Rs. 829.36, as compared with Rs. 6,206.20. An appreciable sum has been recovered during year 1933 for debts previously written off as bad.

Depreciation of Stock, etc., is Rs. 53,756.43, as compared with Rs. 60,611.11.

The items for Fixing Cookers and Fixing Geysers are less, and the Company had at the close of the year 2,048 Cookers and 1,355 Geysers out in the Town. Geysers and Califonts show a net increase for the year of 64, whereas, Cookers decreased by 65.

Bonus to Local Staff and Workmen cost Rs. 22,819.15, as compared with Rs. 24,307.51. The slightly lesser Rupee profit accounts for this reduction.

Ceylon Income Tax is higher by Rs. 1,672.20, due, principally, to the final adjustment of Tax for the previous year. Dominion Income Tax Relief is claimed in London from the Tax Authorities, and our Shareholders receive proportionate relief from Tax on Dividends paid to them.

On the credit side of the Revenue Account Gas Rentals fell from Rs. 698,353.28 to Rs. 645,675.16. The price of Gas for ordinary lighting and heating was the same. Discounts for large consumers, however, were increased as from 1st October last. The price for Public Lighting was reduced by 25 cents as from November, 1932; therefore, for the whole of the year under review Gas for Public Lighting was charged at 25 cents less per 1,000 cubic feet.

During the year 7 new roads and lanes were Gas-lighted to Council's orders and 31 new Columns and Lamps erected. The total length of our Gas Mains at 31st December last was 138 miles 397 yards.

Receipts from Residual Products were Rs. 164,033.99, as against Rs. 192,036.12 for year 1932. The general sale of residuals throughout the year gave rise to uneasiness, especially in the matter of Coke. At times, it seemed almost impossible to sell any, even at "dump" prices. Now that the Estates are working in better circumstances up-country orders have increased somewhat. Tar for roadways showed marked increases, and I am pleased to say this has been maintained in January and February this year. In fact, we are now fully booked up with Estates orders, which is most satisfactory.

Accounts grouped under the heading of Gas Fittings amount to Rs. 69,776.34, as compared with Rs. 71,846.57 for the previous year.

The profit for the year is about the same as for year 1932, which is, in the opinion of your Directors, very satisfactory, in view of the depressed state of the Colony which prevailed throughout the whole year.

The question of ordinary expenditure, consistent with the economical working of the business, is constantly before your Directors, and every effort is made, both in Colombo and London, to increase our business.

I should like to draw your attention to one item in the Balance Sheet and this is our Investments Account. At the end of year 1932 the book value was £31,857, with a market value of £39,797. During the year ended 31st December last, further purchases of Gilt-edged Securities have been made, and it is very pleasing to record that our Investments as at 31st December last now stand at the substantial figure of £37,887, with a market value on that date of £46,488, and the value to-day is even much higher than this figure.

These are, I think, all the comments I need make on the Accounts.

The Balance of Net Revenue is £20,424 6s. 6d. and the Directors recommend a final Dividend of 3½ per cent. on the Preference Shares and a final Dividend on the Ordinary Shares of 5 per cent. both less Tax.

Before I move the adoption of the Accounts, there are one or two matters to which I should like to refer:—

The first is the absence of our Director, Mr. John G. Wardrop. It is many years now since we have not had the pleasure of Mr. Wardrop at our Annual General Meeting and only illness prevents him from being amongst us to-day. I feel I am voicing the feeling of the whole Meeting in wishing him a speedy recovery to good health again.

Secondly, at our last Meeting, in May of last year, I referred to the illness of Mr. A. C. Pullen, our Secretary since 1921. Mr. Pullen has, unfortunately, not been able to resume business and your Directors have therefore found it necessary to make a change in the Secretaryship of the Company. Mr. S. F. Field who, for many years, has been Assistant to Mr. Pullen, has been appointed to the position.

In consideration of the long and faithful service rendered by Mr. Pullen the Directors have granted him an Annuity of £150 as from 1st January last, which, I feel sure, you will all approve.

Lastly, during the year under review the Company has been negotiating with the Colombo Council for a further Public Lighting Contract and, after a lengthy discussion and in spite of severe Electric competition, we have secured the Contract for a further period of five years as from 1st January last, which your Board consider most satisfactory and which shows how efficiently the Company carries on the Gas Lighting of Streets entrusted to us.

I have now pleasure in moving that the Report and Accounts be received and adopted.

Mr. ALEX A. JOHNSTON seconded the motion.

Mr. S. J. TUNGAY asked a question on the manufacture of Sulphate of Ammonia to which the Chairman replied.

The Company's Manager also explained the position as to the manufacture and sale of such a by-product as Sulphate of Ammonia in Ceylon.

The Resolution was carried unanimously.

The CHAIRMAN then moved the following Resolution:—

> "That a Dividend for the year ended 31st December, 1933, at the rate of Seven per cent. per annum upon the Preference Shares, less Income Tax, and Ten per cent. per annum upon the Ordinary Shares, less Income Tax (both less Interim Dividend paid 17th October, 1933) be and is hereby declared, the Warrants to be payable on 28th April, 1934,"

which was seconded by Brig.-Gen. GOLAND V. CLARKE and unanimously carried.

Mr. ALEX A. JOHNSTON proposed the re-election of Mr. Robert H. Glen and Major Heriot R. Glen as Directors of the Company and said that the position of the Company is sufficient to show the splendid way the Chairman has carried it along through a trying time. The Board works as a happy family and he had no hesitation in proposing the Resolution.

Brig.-Gen. GOLAND V. CLARKE seconded the motion, and referred to the enormous amount of work put in by the Chairman and to the confidence inspired by him and Major Heriot R. Glen.

The Resolution was carried unanimously.

The CHAIRMAN returned thanks on behalf of himself and Major Glen and referred to the deep interest they have in the welfare of the Company. It was a pleasure to know that their work was appreciated and he could assure them it was not grudged.

Mr. S. J. TUNGAY proposed that Mr. William Cash, Junr., M.A., F.C.A., be re-elected Auditor for the current year at a fee of ninety guineas. Mr. G. T. WEST seconded the Resolution, which was carried unanimously.

The CHAIRMAN proposed a vote of thanks to the Company's Officials in Colombo and London. He said it was a pleasure to have the Company's Manager, Mr. S. Barker Johnson, with them to-day. Conditions have been very bad in Colombo, but the hard times they have gone through have been met by hard work. There is one feature very much to the credit of our Local Staff, particularly of the Manager, namely, the securing of the Gas Contract from the Municipality for a further five years. Competition is very much greater now and the feeling in local Politics is much less amiable towards British Companies. Our best thanks are due to the Manager and his Staff in this connection.

As regards the London Staff, we regret very much no longer having Mr. Pullen with us, but we have a fine successor in Mr. Field. He has filled Mr. Pullen's place with shining success and he and his Staff give every satisfaction.

The Resolution was seconded by Mr. T. W. WELSH, and carried unanimously.

The COMPANY'S MANAGER, Mr. S. Barker Johnson, replying on behalf of the Staff, thanked the Meeting for the vote. He

could assure the Meeting that they in Colombo seldom looked on life through rose-coloured glasses now-a-days. The Colombo Municipality Contract was secured after no ordinary efforts, we had come up against very great opposition. The securing of this Contract could be regarded as a signal victory for Gas, and, although it was risky to venture an opinion, he thought conditions in Colombo were improving. He referred to the pleasant relationship between himself and Mr. Pullen and was confident this feeling between the London Office and Colombo would be pursued unbroken.

Mr. S. J. TUNGAY moved a vote of thanks to the Directors, which was seconded by Mr. T. W. WELSH, and carried unanimously. An expression of sympathy with Mr. Wardrop was incorporated. The Meeting then terminated.

Cape Town and District Gas Light and Coke Company, Ltd.

ANNUAL GENERAL MEETING

The Forty-Fourth Ordinary General Meeting of the Cape Town and District Gas Light and Coke Company, Ltd., was held at the Company's Offices, 38, Grosvenor Gardens, S.W. 1, on Friday, April 27, 1934, at 12.30 p.m.—Mr. C. W. LILLEY, Chairman of Directors, presiding.

The MANAGING DIRECTOR AND SECRETARY (Mr. R. W. Blackburn) read the notice convening the meeting, together with the Auditors' report on the balance-sheet.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN said that the next business on the agenda was the motion to adopt the report and accounts for the year, and, before coming to that subject, he had to inform them that Mr. Fairclough, after rendering valuable services to the Company for more than 40 years, had been compelled by reasons of health to resign his seat on the Board.

Continuing, the Chairman said: There is no denying the fact that the results for the year have been very disappointing both to the Directors and the shareholders. I propose to give you the reasons for that, and I also propose to give you reasons for the anticipation of substantially better results for the present year if the course proposed by the Directors to be taken is adopted. In order that you should give your consent to the proposals of the Board, it is necessary for me to deal rather fully with the existing state of affairs.

There are three main reasons for the state of affairs disclosed by this year's accounts. They are: (1) The competition of the Electrical Undertaking of the Corporation, which I referred to last year as being, in our opinion, competition not wholly fair to the Company. (2) The loss of the gold premium along with the maintenance of the charges imposed originally to off-set its advantages to importers like ourselves. (3) The continuance of the very severe depression to which I referred in my speech last year.

I shall deal with each of these heads in their turn. I shall indicate the steps taken to meet them, and I shall deal quite frankly with the problems raised. Lastly, I shall deal with the proposal now before the meeting to increase the borrowing powers of the Company, and the reasons why those powers are vital to the successful conduct of the Company's business.

Before dealing with these more general matters, however, I propose as usual to comment shortly on the accounts for the year as they stand. In the first place, you will observe that the accounts are in a new form; they give in much more detail than before the figures relating to the Company's business, and the Board has already had evidence that the alteration is welcome.

Dealing, first, with the revenue account, on the income side you will observe that the proceeds of gas sales at £66,830 are less by £8,956. That decrease is due entirely to lower gas charges and lower consumption per consumer. The shareholders were informed last year that it had been necessary to reduce the price of gas to the lowest possible figure in order to compete successfully with the charges made for electric current. The new tariff came into operation at the beginning of the year at a time when a steady loss of consumers was taking place. The result of its adoption was necessarily at first to decrease revenue from gas sales, but if it had not been adopted, we are entirely satisfied that the loss of consumers and of gas sales would have been both progressive and rapid. Towards the end of the first quarter of the year, however, the new tariff had the effect, not only of stemming the decline in the number of consumers but of turning the tide the other way. As you will see by the report, the end of the year shows an increase of 146 consumers over the number in the corresponding month of the previous year, and the total figure rose to over 7,300. The grave depression in business generally, however, is shown by the fact that consumption per consumer again decreased during the year by about 400 c.ft.

EFFECT OF DECREASED PRICE.

The effect of the decreased price for gas is again apparent, and more favourably apparent, in the next item under the heading of fittings, &c., sales, which reached the figure of £6,098, representing an increase of £1,477. The gross sales of fittings during the year rose from £3,800 in 1932 to £8,400 in 1933, being an increase of more than 100%. That is an exceedingly important figure, because it will necessarily be reflected in the consumption of gas in the future. Residuals' sales increased by about £1,000. These increases, of course, partly offset the reduced revenue on gas sales for the year, and total income on Cape Town Account was less by £6,554.

On the other side of the same account, coal carbonized increased by £783 owing to an increased consumption of something over 500 tons. The working expenses in Cape Town were substantially the same for the year; there was a very small decrease. Wages and salaries were slightly lower, and so were rent, rates, and taxes. The figure of maintenance of hire, stoves, fittings, &c., rose by about £700, owing to the increase in the number of fittings of this sort out on the district.

If the reduction of price charged for gas was to yield its results in any reasonable time, it was essential to undertake contemporaneously a publicity campaign so as to make it as widely known as possible. That is the explanation of an increase in the figure for advertising and gas demonstrations to £5,000, being an increase of £1,500 in round figures. That that money was well spent is proved by the increase in the number of consumers, and by the fact that, although the volume of gas sold showed a serious contraction at the beginning of the year, over the whole year the decrease of sales of gas was stemmed, and was later turned into considerable increases, as a result of which the figure for 1933 is substantially equal to that of 1932.

The total expenditure for the year in Cape Town was £69,080, which is in excess of that of the previous year by about £2,200. That excess arose substantially from the two items I have mentioned. The balance from Cape Town was, therefore, £16,898, which is the first figure on the right-hand side of the account under the heading "London." That balance was less by £8,800, and, unhappily, the diminished return was not compensated for, as was largely the case last year, by the difference in exchange between London and South Africa. As I informed the shareholders in my speech last year, that item was not a continuing item, and we have not the benefit of it in this year's accounts, save to the trifling extent of £50, as against £6,500 last year. Expenditure in London—always a small item in our accounts—shows a reduction in the first item of rent, salaries, &c., by £58, and Directors' fees are £179 less. The balance to net revenue account, however, being reduced by the large reduction in the Cape Town balance, and by the loss of gold premiums, reduces the balance carried to net revenue account by £15,000 to a figure of £13,383. The amount carried forward from last year was £8,233 after payment of the final dividend on the ordinary shares for that year, with the result that the sum carried to net revenue account is £21,616. That is appropriated, as you will see on the left-hand side of the account.

The Directors thought it right to pay the dividend on the preference shares at the beginning of May and November last year, since the dividend is cumulative, and the carry-forward from the previous year was much more than sufficient to pay it. Debenture interest absorbs £11,750—an increase of £2,500—but general interest on loans was less by £1,800. The item of sinking fund premium absorbs £1,977. The balance carried to the general balance-sheet is thus £1,180 only.

CAPITAL ACCOUNT.

On capital account the item of works, buildings, &c., is increased by £8,663, and the increase is entirely due to the addition of new mains, services, and installations. The capital subscribed is increased by the figure of £50,000 as a result of the issue of the remaining 50,000 5% debentures which I referred to and explained in detail last year. The sum received on that account was applied in the payment off of loans and other liabilities for plant and goods supplied.

If you will now turn to the general balance-sheet, on the left-hand side, bills payable amount to £9,290; on the other hand, sundry creditors at £37,500 are less by nearly £6,300. The reserve and contingency account remains the same, save that there is deducted from it a sum of £2,125, representing the discount on the issue of the 50,000 debentures. On that side of the balance-sheet, there was last year an item of £38,000 for loans. That item has wholly disappeared this year by reason of the payment off of loans which I have mentioned in dealing with the capital account.

On the assets side of the balance-sheet the first item, balance on capital account, represents the excess of capital expended over capital received. That amounts in round figures to £100,000. The value of hire fittings on the district has increased by nearly £900. Stock in store or in transit is £3,300 higher owing solely to increased shipments of cookers, geysers, and other gas appliances. Sundry debtors less necessary reserve have increased by £2,800—that excess being due principally to amounts outstanding on the extended credit system adopted.

ELECTRICAL COMPETITION.

For the moment, I will leave the accounts in order to deal with the three matters which I mentioned at the beginning of my speech as being mainly responsible for these results. The first

is the Corporation tariff for electrical supply. During the year 1932 in particular the Electrical Authority undertook an intensive campaign to increase the use of their product in Cape Town. Under the special tariff adopted, electricity was obtainable at a rate which is actually, in certain cases, below the cost of production, provided the consumer would agree to use current for cooking and heating purposes in addition to lighting. The domestic tariff rate offered for a service, including lighting, heating, and cooking, was brought down to a charge of ½d. a unit for current, together with the service charge of 1s. 8d. a month in respect of each room in which electricity was used. The Corporation also provided wiring facilities and offered extended credit terms for the purchase of electrical appliances. This competition the Board cannot consider fair economic competition, nor are there wanting signs that persons who appreciate the position in Cape Town are beginning to be apprehensive about the situation.

For the time being, however, the tariff is in force, and the Company is compelled to meet the situation. We now provide facilities equal in the way of service and credit terms to those offered by the Corporation. Meter rents were abolished, a tariff based on service charge and a low rate for gas was offered as an alternative in certain cases, and all gas appliances were made available to be purchased on extended credit terms. By the adoption of these methods and a resolute campaign to make them known, we did, in fact, succeed in turning a loss of consumers into a gain of consumers, and after the first quarter of 1933 in increasing sales of gas. That programme, however, has been costly, as will be seen by the accounts, and it has involved the Company in heavy expenditure, and the Company, of course, has not the advantage of public funds to fall back on.

We disburse in Cape Town over £75,000 a year, and, as large employers of labour and ratepayers, we do not see the justification for the supply of current to certain consumers at a price below production costs. There are many directions in which gas is definitely superior to electricity. It would be a real injustice to the general community of Cape Town if the Corporation as electrical authority designed their policy with a view to depriving the citizens of the use of gas. Happily in the circumstances it is apparent that the measures so far taken have fairly met the situation, and have enabled us to hold, and indeed to improve, our position. If we are provided with the necessary financial facilities, the Board has every reason to believe that the Company will find it possible to increase its business and earn reasonable profits.

The second matter I mentioned was the loss of the gold premium which we hoped would have been accompanied by a corresponding removal of the charges imposed on imported goods at the time when the premium existed. The loss of premium was obviously to be expected, but the maintenance of heavy duties has been a great disadvantage, the prospect of relief from which I discuss under the next head.

Existing Depression.

The third matter to which I referred was the continuance of the existing depression. I mentioned to the shareholders last year that a National Government had been, or was being, formed to deal with the very grave situation then existing in South Africa. Happily there are indications that either from that cause, or a combination of that and other causes, the severity of the depression is lessening. Railway returns are higher, the recent Union Budget disclosed a satisfactory surplus, taxation is being lightened, and import duties are to be lowered. These are all circumstances which point to a return of prosperity. There is no doubt that our own business will respond to improving conditions if means are available to take advantage of the opportunity.

During the whole of the past year, the Board has been faced with constant demands for gas appliances in Cape Town to meet expanding demands. These demands had to be financed as best we could. We had to give the same extended facilities for payment as were given by the Corporation; we had to obtain facilities for deferred payments from suppliers of goods here. Those facilities, however, are not as extensive as those we have to give to our customers there. There is, therefore, a substantial lag in this respect between income and expenditure. During the course of the year we had an opportunity of obtaining a sufficient sum of money to enable us to finance large demands for goods, and to extend repayment over the necessary period. Legal opinion, however, was taken, and it was stated that the Board had no authority under the Articles to borrow, save by means of overdrafts of a purely temporary character.

Having regard to the conditions which I have mentioned those powers were not adequate, and that is the sole reason why we have to ask you to pass the resolution of which notice is given for this meeting. The form of the resolution would give us power to raise an additional £50,000. It is not necessary, nor would it be sound policy, to attempt to borrow this sum on a funded basis. It is, however, absolutely vital, if the Company is to hold its position, and meet its obligations to its creditors, that the Board should be in a position to finance new business.

For the last year the position has been that cash has had to be used in paying for goods essential to take advantage of our opportunities and to increase our earning powers.

The Dividends.

For the first time for many years we cannot pay an ordinary dividend, and it is necessary, at all events for the present, to postpone the payment of preference dividend which is due to be made on May 1st. Whether that preference dividend can be ultimately paid must depend upon the results to be achieved in the present year and upon your answer to the question whether cash must continue to be diverted to meet commitments for extra appliances. Our staff in Cape Town is sanguine of securing results if they can be supplied with the necessary goods. It is, however, quite impossible for the Company to finance heavy demands and still find the means to pay ordinary outgoings, in which I include the payment of preference dividend. As to ordinary dividend, I should not feel justified in making forecasts at this juncture. The resumption of payment of ordinary dividends really depends upon our increasing our consumers and upon trade recovery in Cape Town enabling those consumers to consume gas to the extent that is usual in ordinary circumstances. It is therefore vital in the interests of all classes of shareholders and of all concerned in the welfare of the Company that we should be enabled to finance the very substantial demands which we are receiving at the present time by almost every mail, for fittings to be supplied to new consumers and extra fittings to be supplied to old consumers. It is essential that the additional production plant should be more fully worked if it is to be used to complete advantage. It is also essential that the very satisfactory results which we have obtained from increased publicity should not be lost to the Company.

During the course of the year the Managing Director visited Cape Town, and has made arrangements for centralizing administration and distribution which will, if they can be carried out, result in substantial saving on revenue account, and will also, we believe, do much to extend the Company's business. The General Manager advises us that he has made such arrangements already as will very substantially reduce working expenses as compared with last year's figures. We have been compelled, much against our will, to cut down salaries paid to a loyal and hard-working staff in Cape Town, and we propose to make some reduction in the small London expenses by drawing a reduced sum on account of our own fees during the current year. These various factors, taken together, are likely to produce a result for this year better—and we hope substantially better—than that of last year; but it is quite impossible that the Company can extend, or even maintain, its present sales, unless the Board is given the extra powers which are necessary.

The Chairman then formally moved the resolution for the adoption of the report and accounts, and Mr. Blackburn seconded.

Lieut.-Col. H. V. Bache de Satge asked whether steps should not have been taken earlier to meet competition, as in London for the past three or four years the gas undertakings had been fighting very hard to meet competition. He was glad, however, to support the resolution, and hoped that in the future they would be more successful.

Unusual Conditions.

Mr. E. Nicholls said they were met that day under rather unusual conditions. They had not anticipated having to face a state of things as now existed; three years ago their prospects looked so encouraging. Then things became somewhat worse, and their dividend was reduced; and now they had to pass the dividend altogether. So evidently they had unusual conditions to face. He would like to know whether they were considering the idea of delivering gas portably. This was being done in some cases, and he wondered whether it would be helpful in Cape Town where mains were not laid. He also inquired if it was possible to do anything in the way of making representations to the Municipality that the Company, which was paying so much in rates, was being exposed to this unfair competition. They must have the additional working capital, and they must face the results before them. He would like to say, from all he had heard from Mr. Blackburn, that his recent visit to South Africa had been very helpful indeed to the Company, and they were indebted to him. He was not prepared to blame the Directors for the present state of affairs; they had been through worse times in the past, when they were unable to pay their ordinary dividend for years and the preference dividends got into arrears. So there was still room for hope in the present circumstances.

The Chairman, replying to the first speaker, said that his criticisms had been made in a most kindly spirit. In regard to the tremendous "assault" made by the Corporation, he said that the reduced electricity tariff came into force in 1931 and 1932. It was to them surprising that the Municipality should supply current as no municipality did in this country—not at an ordinary competitive rate, but at a rate which was actually below production cost—that was to say, below the cost of delivery to the consumer. The difference between the tariff for ordinary domestic lighting and the "all-in" tariff was a maximum of 4d. for the ordinary lighting. That was to say, if one took a house in Cape Town one paid 4d. a unit for lighting, and one was invited, as a result of an intensified campaign, to get one's lighting, heating, and cooking at the expense of others who paid higher rates for electricity, at below delivery cost. The Directors had always felt that they would have liked to reduce the price of gas earlier, but production costs had to be carefully considered. They would go on pushing appliances had they capital available to do it. Their Company did a great deal in the way of supplying business concerns, and these immediately felt the effect of depression—domestic consumers felt the effect later.

In reply to Mr. Nicholls, the Chairman said that they had been considering the question of cylinder gas; but at the present time he did not think it had reached a practical stage of develop-

ment. They were, however, actually making full investigations and tests. Regarding representations to the Municipality, he thought that a formal representation to the Corporation suggesting that their electrical undertaking was supplying current at too low a rate to be economic would be a difficult matter. All the people taking advantage of the electrical tariff would be highly critical of the attitude of the gas supply. The shareholders had been very kind in what they had said—and what they had not said—on this occasion, and he assured them that the Board had taken expert advice in regard to all the steps they were taking.

The resolution for the adoption of the report and accounts was then put to the meeting and carried unanimously.

Increased Borrowing Powers.

The Chairman next moved:

"That the Directors' power to borrow, conferred by Clause 70 of the Articles of Association of the Company, as extended by a special resolution confirmed in February, 1903, be further extended, so that the amount at any one time owing in respect of moneys so borrowed or raised shall not, without the sanction of a general meeting, exceed £300,000."

This was seconded by Mr. Blackburn and unanimously agreed to.

Re-Appointment of Director and Auditors.

The Chairman moved the re-election of Mr. W. J. Bradford, being the Director retiring by rotation, and this was seconded by Sir George L. Barstow, K.C.B., and carried unanimously, Mr. Bradford briefly acknowledging.

On the proposition of Mr. Nicholls, seconded by Mr. G. N. Planterose, the Company's Auditors (Messrs. Kemp, Chatteris, Nichols, Sendell, & Co.) were re-appointed.

The Chairman observed that the Directors were having a very anxious time and a very strenuous time and were most admirably seconded by the efforts of the staff in Cape Town. It was with great regret that they had had to cut down salaries—but it had been unavoidable. He assured them in conclusion that everything possible was being done to meet the present situation.

Vote of Thanks.

On the proposition of Mr. Nicholls a hearty vote of thanks was accorded to the Directors and staffs of the Company in London and Cape Town for their work during a very difficult period, which the Chairman briefly acknowledged, this concluding the business of the meeting.

Huthwaite U.D.C. Gas Order

Question of Bulk Supply

Some rather unusual points arose at the inquiry held at the Board of Trade Offices, Westminster, on Friday, April 27, before Mr. J. F. Ronca, O.B.E. (Director of Gas Administration), into a Special Order promoted by the Huthwaite (Notts.) Urban District Council.

The Huthwaite Council, who have no powers to erect gas-works, and are dependent on a bulk supply of gas, have been obtaining such a supply for many years from the adjoining area of the Sutton-in-Ashfield U.D.C., who have their own gas-works. Being dissatisfied with the supply, the Huthwaite Council have made an arrangement with the Derby Gas Light and Coke Company (who are obtaining a supply of coke oven gas from Blackwell Colliery, which is within two miles of the Huthwaite border, and have purifiers there), for a supply of coke oven gas at a much lower price than they are now paying to Sutton. A main must be provided from Blackwell to the Huthwaite border, and inasmuch as the Derby Company's Acts did not give the Derby Company power to lay the main, it was necessary for the Huthwaite U.D.C. to obtain the powers. Hence the present Order, which proposes to authorize the provision of the main and the borrowing of the money. There are also provisions to enable the U.D.C. to charge for gas on the calorific value basis, as well as a number of common miscellaneous provisions.

The opposition came from the Sutton U.D.C. and the Nottinghamshire County Council, and concerned mainly the proposal to obtain the bulk supply from the Derby Company. The principal consideration was that, by reason of the recent review of local areas, the Huthwaite area is to be absorbed, as from April, 1935, by the Sutton U.D.C., and the latter authority will become responsible for the supply of gas in Huthwaite, as well as for its local government. It was urged that if the arrangement now proposed by Huthwaite were implemented, it would impose a burden on the Sutton undertaking when it became responsible for the supply of the joint area.

Late in the inquiry it was stated that the Sutton U.D.C. are negotiating for a bulk supply of coke oven gas from the Mansfield Corporation, at an even lower price than that at which the Huthwaite U.D.C. proposed to obtain a supply from the Derby Company.

The Nottinghamshire County Council also asked for a protective clause with regard to the laying of mains in highways, and a clause was agreed upon.

Mr. H. Royston Askew (for Huthwaite U.D.C.) said that the first agreement with the Sutton U.D.C. for the bulk supply expired in 1918, when the price charged for it was 2s. 9d. The Sutton U.D.C. would not then renew it, but offered to supply at 4s. per 1,000 c.ft. (in view of the conditions then existing) for three months, when they could renew for a further three months. The Huthwaite U.D.C. were given nine days in which to accept. Thus, they were forced to take the gas at that price, and to raise the price to their consumers by about 1s. 3d. per 1,000 c.ft. Though there was no agreement, Sutton still supplied, the present price of the bulk supply being 3s. 3d. net, which was extremely high, by reason of the position of Huthwaite on the coalfield. There had been many complaints of inadequate pressure, but the Huthwaite U.D.C. was unable to secure redress. The main carrying the bulk supply also supplied houses en route (in the Sutton area). The price in Huthwaite was 5s. 3d. per 1,000 c.ft. to ordinary consumers, and 5s. 6d. to slot meter consumers. So bad was the pressure that it was impossible to use gas satisfactorily for some purposes; and that fact, coupled with the high price, very much hampered the development of gas supply. Many consumers were unable to use gas for heating, and were using it only for lighting. Thus, the sales in Huthwaite were relatively low.

During the last few years the Huthwaite U.D.C. had repeatedly tried to obtain gas elsewhere, and there had been negotiations with a large colliery company, which negotiations had failed through no fault of the U.D.C. However, the first real ray of hope had appeared in the early part of 1933, due to the fact that the Derby Gas Light and Coke Company had arranged to obtain coke oven gas in bulk from the Blackwell Colliery (within a mile or two of the Huthwaite boundary) and had erected a purifying plant adjoining the colliery. The Huthwaite U.D.C. had approached the Derby Gas Company, and had concluded an agreement whereby the Company would supply purified coke oven gas to the U.D.C. from a point at or near the purifying plant, for a period of seven years. The price was to be 1s. 3d. per 1,000 c.ft., based on an average price of 14s. per ton for coal used by the Derby Gas Company, and there was to be a rise or fall of $\frac{1}{16}$d. per 1,000 c.ft. for every rise or fall of 6d. per ton in the price of coal. That coal clause, said Counsel, did not exhibit the striking unfairness of the clause contained in the original agreement with Sutton.

In order to secure the supply, it would be necessary to provide 2,800 yards of main from Blackwell to the Huthwaite boundary and a further 1,100 yards within the Huthwaite district, the diameter to be 8 in. for the greater length and 6 in. for the shorter length. The length within the district would require replacement in any case, so that its cost should not be debited *in toto* against the bulk supply. The total cost of the works necessary to enable the supply to be given—which included the mains, connections, meters, governors, and various incidentals—was £5,338.

The price to be paid for the gas would be 2s. per 1,000 c.ft. less than the price paid for gas to the Sutton U.D.C. The loan charges on the new main would amount to approximately £300 per annum, assuming the loan was to be repaid in 30 years. That was equivalent to about 5½d. per 1,000 c.ft. supplied in Huthwaite, on the basis of the existing small consumption. Thus, there would be a clear saving of 1s. 6½d. immediately. The main was designed for a much larger supply, however, and increased consumption could reasonably be expected, in which case the charges for the main would become less per 1,000 c.ft. of gas sold, and the saving would increase.

The reason why it was necessary for the Huthwaite U.D.C. to promote this Order to authorize the laying of the main outside its area of supply was that the Derby Company had not the power to do so, though the Derby Company had power to supply in bulk.

Mr. H. F. Bidder (for the Sutton U.D.C. and Notts. C.C.) raised the objection that the Derby Company could only give the bulk supply with the consent in writing of the local authority of the district within which the supply was to be given, or of the suppliers of gas in that district. Within a year the Sutton Council would be the local authority and the gas undertakers in Huthwaite, and it would be open to them then to withdraw any consent which had been given by the Huthwaite Council. It would be against the spirit of the Derby Company's powers if the Company made an agreement for seven

years, knowing that the local authority who would be responsible for the district concerned during the greater part of that period did not agree with that course.

Mr. ASKEW said that the attitude of the Sutton Council surprised him more and more. Local areas were changed from time to time in this country, and it would be impracticable if agreements were to be altered or torn up every time such changes were made. The Huthwaite Council submitted that their proposals were in the interests of their gas consumers; and it was merely by reason of the chance that the Derby Company's limits of supply did not adjoin the limits of the Huthwaite U.D.C. that the promotion of the Order was necessary. If the limits had adjoined, the agreement would have been carried out already, and the main-layers would have been at work.

In the objections submitted by the Sutton Council it was stated that the price charged to consumers in Sutton was less than that charged in Huthwaite, and that when the amalgamation of the areas occurred the Huthwaite consumers would get the benefit of the lower price if the gas were supplied from Sutton. Mr. Askew asked if the Sutton Council would undertake that.

Mr. BIDDER replied that the Sutton Council would undertake not to charge more for gas in the Huthwaite district than they charged in the Sutton district.

Mr. ASKEW, commenting on the objections, said they exhibited a complete misconception of the position. The whole question of the revision of areas for local government jurisdiction was an entirely different subject matter from the question of gas supply, and it had been confirmed over and over again that it had little or no bearing on what were the proper areas for the supply of water, gas, electricity, and other public services.

Mr. BIDDER said that in this case it was not merely a question of the change of boundaries for local government, but of the extinction of a local authority and gas undertaker.

Mr. ASKEW urged that that did not touch the point and that a convenient area for gas supply was not necessarily the best for local government; gas and water supply problems must be dealt with on their merits.

The price at which the gas was proposed to be supplied by the Derby Company seemed to be cheaper even than the cost price of gas made by the Sutton undertaking, and the arrangement made with the Derby Company was extremely advantageous.

With regard to the Notts. County Council objection, they had submitted that no new or additional powers should be given to a District Council which was doomed to early extinction, and that the proposals in the Order might prove burdensome to the Sutton Council. Mr. Askew urged that gas supply was not one of the duties of County Councils, and that the Council had no proper *locus* to be heard.

Mr. *E. B. Hibbert* (Clerk to the Huthwaite U.D.C.), in the course of evidence, said that if the supply were obtained from Derby, the price to consumers in Huthwaite could be reduced to about 4s. per 1,000 c.ft.

Mr. BIDDER, in cross-examination, said that by the time the U.D.C. had obtained the necessary sanctions and had constructed the main, the supply from Derby might not be taken until about nine months hence, and three months after that the scheme would have to be administered by the Sutton Council. Then the amalgamated district would have to meet the loan charges and bear the risk.

Mr. *Hibbert* would not call call it a risk; and he added that the supply would probably be available in less than nine months.

With regard to prices, Mr. Bidder said that in 1918, when the price of the bulk supply was 4s. per 1,000, the Huthwaite U.D.C. had charged their consumers 5s. 3d.; but to-day, with a bulk supply at 3s. 3d., they were charging consumers 5s. 6d. The agreement with Derby did not guarantee pressure or quality; yet the Huthwaite Council, under the powers sought in the Order, would have to maintain a statutory pressure and declare the calorific value of the gas they supplied.

Mr. *Hibbert* replied that the Council would be receiving gas similar to that supplied to the Derby Corporation.

Mr. BIDDER pointed out that if the coke oven plant went wrong or closed down altogether its owners would be under no liability. The Sutton undertaking, on the other hand, had facilities for the storage of more than one day's demand and also had water gas plant available as stand-by. It was dangerous to rely on the coke oven supply in view of the possibility of breakdown.

Mr. *Hibbert* considered that the suggestion was exaggerated.

Mr. *E. W. Bostock* (Surveyor and Gas and Water Engineer, Huthwaite U.D.C.), who also gave evidence, said the reduction of the price of gas would lead to its largely increased use.

With regard to the Derby supply, he said the Derby Company had storage capacity for over 5½ million c.ft.; large numbers of consumers in the Derby Company's area would be dependent on supplies of coke oven gas, just as Huthwaite would be.

Mr. BIDDER, cross-examining, asked what reason there was to think that Huthwaite would have a claim on the gas stored in the Derby Company's gasholders.

Mr. *Bostock* replied that the Derby Company would not lose a good customer if they could avoid it, and he had faith in the Company.

Mr. BIDDER pointed out that the Derby Company were under statutory obligation not to supply in bulk unless the consumers in their own area were fully supplied.

Mr. *Bostock* asked if the Sutton Undertaking were not in the same position.

Mr. BIDDER replied that they were not. With regard to the loan charges for the main, he said that if the main were amortized over a period of seven years instead of thirty it would represent a charge of 1s. 3d. per 1,000 c.ft. supplied, on the basis of the present demand, so that the Huthwaite price would have to be 4s. 10d. per 1,000 instead of 4s. The present charge made by the Sutton Undertaking to their ordinary consumers was 4s. 3d. net, and he had undertaken to supply at the same price in Huthwaite as in Sutton.

Mr. ASKEW said that the Huthwaite U.D.C., if they had the Derby supply, would charge 4s. to slot consumers and 3s. 9d. to ordinary consumers.

Mr. *George Evetts* (Consulting Engineer), giving evidence in opposition, said he considered the agreement between the Huthwaite U.D.C. and the Derby Company was not a good one. He also pointed out that the output of the Sutton Undertaking was 127 million c.ft. per annum, and the bulk supply to Huthwaite was about 13 million c.ft.—*i.e.*, about 10% of the total output. From the point of view of gas supply over the whole area, he said it was wrong in principle that 10% of the gas supplied should be made the subject of a separate bulk supply contract. The additional 10% make at the Sutton Works would cost very little more than the net cost of the coal; the amount saved if this 10% extra were not made at Sutton would not be so great as the expense of providing the main for the supply from Derby. If Sutton and Huthwaite were one area of supply, an arrangement of this sort for 10% of the supply would not be considered. If a gas company in Sutton were negotiating to take over the Huthwaite area, one of the conditions would be that the Huthwaite Undertaking should not make an agreement of this type in the interval prior to the undertaking being handed over.

The condition of the plant at the Sutton Works was rather above the average, the output capacity was more than sufficient, and there was more than a day's storage capacity. There were also possibilities of the Sutton Undertaking obtaining coke oven supplies. The Sutton Gas Committee had always had that in mind, and recently the Mansfield Corporation had offered a supply of purified coke oven gas to the Sutton Undertaking, at a point 2 miles from the Sutton Gas-Works, at a price lower than that at which the Derby Company had offered to supply Huthwaite. Negotiations were in progress, and the basis for the discussion was the supply at a fixed price for 21 years, the maximum requirements of the Sutton Undertaking being met for that period, the guaranteed quality of the gas being 475 B.Th.U. per c.ft. The two parties were meeting early in May to discuss the matter. If the Sutton Undertaking could make a satisfactory agreement on that basis he would unreservedly recommend them to accept it, and to put in water gas plant capable of making, roughly, 50% in excess of the present maximum daily output, as a stand-by.

An expenditure of £5,300 for a main for the Derby supply, the extent of which was only 13 million c.ft. per annum, was rather heavy. And if the supply of coke oven gas by the Colliery Company to the Derby Company were to cease, the supply to Huthwaite would cease, and it was possible that under the agreement the supply would fade out within six months. He had known of more than one case where coke oven owners had said they would not continue making coke merely in order to supply gas, if there was a reduced demand for coke.

As to the amortization of the proposed main, he suggested that the Ministry of Health was likely to allow only 20 years instead of 30 years for repayment if a steel main were laid; so that the cost per 1,000 c.ft. supplied would be more than 5½d. to meet the charges on the main.

He had been told at the Sutton Works that the pressure there was 6½ to 7 in., and that at the Huthwaite meter house it was never below 48/10ths, even at times of peak load. It would appear that if there were pressure difficulties they were due to conditions in the Huthwaite area.

Mr. ASKEW said there had been general complaints in the Huthwaite area.

Cross-examined, Mr. Evetts agreed that the price charged by Sutton to Huthwaite during the past two years was on the high side, and that the Sutton Undertaking could afford to charge less to-day.

If the proposed arrangement for a bulk supply from Derby were fulfilled, the Sutton and Huthwaite areas, considered as a whole, would be £500 a year worse off than if it were not fulfilled. He would sooner spend £5,300 on the works than on a main to carry only 10% of the total supply.

Mr. BIDDER, summing up, said that for the Huthwaite authority to put forward a scheme which could not possibly be put into operation until a few months before the supply in Huthwaite was handed over to the Sutton Undertaking suggested an unreasonable misconception of the situation, resulting in burdening the Sutton Undertaking with the execution of a project which it did not originate and of which it thoroughly disapproved.

Mr. ASKEW urged that the Huthwaite U.D.C. had made the best bargain they could in order to provide cheaper gas for the consumers.

He asked that, if the Board of Trade did not advise the granting of the provisions with regard to the Derby supply, there should be a provision giving legal effect to the undertaking of the Sutton Council to charge the same for gas in Huthwaite as in Sutton.

Mr. BIDDER said he would oppose the inclusion of such a clause in the Order.

NOTES ON PLANT AND PROCESSES

Peebles Gas Governors.

An illustrated catalogue published by Messrs. Peebles & Co., Ltd., of Tay Works, Bonnington, Edinburgh, deals with some of the larger and later designs of governors manufactured by the firm for gas-works and the distribution of gas for varying conditions of supply requirements.

It is now nearly three-quarters of a century since the business of Peebles & Co., Ltd., was established, and every endeavour is made to keep in the first rank of progress in the Gas Industry. Their pressure-loaded station and district governors—originally invented and patented by the late Mr. D. Bruce Peebles—have been extended in their application and new patents acquired for their improvement and development. The relay system for the operation by water, air, or gas pressure is now available in both the butterfly valve relay (B.V.R.) and cylindrical valve relay (C.V.R.) types. These are particularly suitable for retort house work. Peebles' patent system of clock control of governors has solved a difficult problem of automatic regulation to a definite time-table and for different conditions one day after another.

The present catalogue deals first with station governors, of which the firm have several varieties to offer, depending upon the conditions and pressures for which they are required.

A Safety Relief Valve.

An apparatus which should be of interest to all gas engineers is the Peebles' automatic safety relief valve for retort houses, which is claimed to be an automatic insurance against accident, explosion, and fire. The valve is connected to the dead end or other convenient position on the foul main, either by the vertical connection or the alternative horizontal connection. The objects of the relief valve are to prevent undue back-pressure caused by the failure or stoppage of suction on the foul main; to prevent undue pressure in the retorts; the automatic prevention of fire and explosion due to the escape of gas, and the immediate automatic use of the foul mains on the resumption of normal conditions therein. Other obvious advantages of this apparatus will occur to the engineer.

To meet the demand for an automatic system of loading gas governors by a pre-arranged time-table, Messrs. Peebles have brought out a design of clock control, which, acting upon a small pilot governor, alters the pressure to be thrown by the main governor as desired. A feature of this mechanism is that the clock will automatically change from week-day pressures to Sunday requirements at about 1 a.m. on Sunday morning, and back again to the week-day pressures at, say, 1 a.m. on Monday morning.

Finally, the catalogue deals with district gas governors and high-pressure diaphragm governors with automatic cut-off.

Automatic Temperature Regulation for Central Heating.

We have received a new publication from the Drayton Regulator and Instrument Company, Ltd., dealing with their range of gas relay type gas-operated regulators for the automatic control of temperature and pressure, regulators from which series can be combined to form complete automatic control equipment for almost any type of gas-heated appliance.

Of particular interest in this series is the Drayton Type G "Variostat"—a simple and effective means of controlling central heating plants to give a uniform temperature in the heated building under all climatic conditions.

The device consists of two liquid filled thermo-sensitive bulbs connected to a common Bourdon tube to the free end of which is attached a flapper controlling a small pilot valve. The Bourdon tube responds to pressure changes in either bulb. Thus if one bulb is installed outside the building and one in the flow from the boiler, assuming a rising outside temperature, the pilot valve will maintain the main gas valve closed until the flow temperature falls to a point corresponding to the outside temperature. Conversely, in

This Model Coin Collector

Was *supplied* in 1901

And is *still* in use

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SOLE MAKERS: SAWER & PURVES
(BRANCH OF METERS LTD.)

NELSON METER WORKS MANCHESTER 10
DERBY ROAD WATFORD
RADFORD METER WORKS NOTTINGHAM

case the outside temperature falls, the main valve will remain open until a corresponding flow temperature is reached. Under conditions of unchanged outside temperature the "Variostat" will respond to changes in flow temperature, operating the main valve as required and maintaining constant flow temperature within close limits.

The "Variostat" anticipates temperature variations in the heated building and adjusts the flow temperature in advance, thus eliminating over and under heating due to residual heat and time lag respectively. Also it is not affected by accidental sources of heat loss such as open doors and windows, and it permits a reasonable amount of manual control of radiators according to the individual wishes of the occupants of the heated rooms.

A New "Ideal Cookanheat" Model.

A new type of "Ideal Cookanheat" for cooking and direct hot water supply has just been placed on the market by the National Radiator Company, Ltd., of Hull, and is being shown on their stand at the Ideal Home Exhibition now running at Olympia.

A feature of this model is the large flat top-plate with four boiling rings, that over the fire containing two other loose rings, and the gas cooking attachment, which enables the oven and three boiling rings in the top-plate to be used for cooking when the coke fire is not alight. It will, additionally, provide an auxiliary means of heat when the fire is low. The third boiling ring is provided with a separate burner.

A few figures concerning this new model (No. 34) may be of interest. The overall width is 36 in. by 24 in. deep. The dimensions of the oven are: Width, 15 in.; height, 13 in.; depth, 15 in. The diameter of the boiler flow outlet and return inlet is 1½ in.

The whole appliance is finished in standard grey mottled enamel, or in green, dark brown, or black, and includes a gas poker with 4 ft. of flexible metallic tubing, with connections, for lighting the coke fire. A splashback, plate-rack, and short length of flue pipe completes this useful dual kitchen appliance.

Register of Patents

Dry Gasholders.—No. 400,543.

Ashmore, Benson, Pease & Co., Ltd., of Stockton-on-Tees, and Bloor, H. E., of York.

No. 14,364. May 18, 1933.

According to this invention the container of a dry gasholder has its open end shrouded against ingress of rain, by a covering comprising a plurality of easily deflectable non-disruptible sections.

Fig. 1 is a diagrammatic sectional elevation through one form of construction.

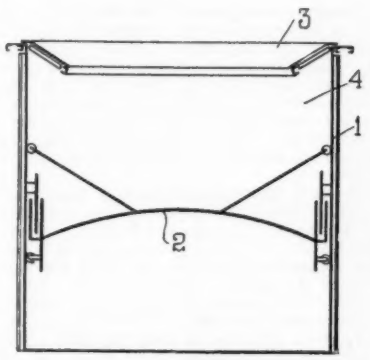


Fig. 1.—Dry Gasholder with Easily Deflectable Roof.

In the arrangement of fig. 1, the walls 1 of the container into the interior of which the piston 2 is displaceable, has at its top edge an internal rigid flange or rim 3, which rim 3 acts as a support for a light roofing of corrugated iron plates, fibre boards, or the like (not shown in the drawing) which may, therefore, easily lift away from the rim 3 whenever the pressure within the chamber 4 between this covering and the piston or diaphragm 2 exceeds the pressure of the atmosphere outside.

Special 3″ Diameter
STANTON-DELAVAUD SPUN IRON PIPE

s. d.
2/1½
NET PER YARD
F.O.T. WORKS

BIG REDUCTION IN PRICE
SPECIAL 3" DIAMETER STANTON SPUN

SPECIFICATION

Actual Bore	3·28 ins.
Thickness	0·25 ins.
Length (effective)	4 yards
Weight	1 cwt.
Coating	Coated both sides, outside only, or uncoated

ADVANTAGES

The external diameter of the pipe and the internal diameter of the socket are to British Standard Specification. The increased bore gives an effective carrying capacity approximately 20% greater than that of an ordinary 3-inch diameter Cast Iron Pipe or Steel Tube.

The Spun metal gives a much larger factor of safety than that obtainable in the ordinary sand-cast pipe, and has a considerable degree of elasticity capable of withstanding high stresses.

All these pipes are hydraulically tested to a pressure of 200 lbs. per sq. in. before despatch.

THE STANTON IRONWORKS COMPANY LIMITED, Near NOTTINGHAM

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The carry-over was responsible for dull conditions at the commencement of business last week, and the reaction was accentuated later by the liquidation which set in in view of the settlement. The gilt-edged market remained quiet and featureless throughout. Towards the close, however, there were some bright spots, particularly in the Industrial section, the favourites being strongly supported. The representations made by the British Government to the German Government on the question of debt payments led to a sharp recovery in the Dawes and Young Loans.

Gas stocks and shares maintained a firm front throughout. An appreciable volume of business was recorded, and several quotations increased in value. Turning, first, to ordinary stocks, Gas Light units again strengthened, the price rising a further 1½d. to 26s. 9d., and, on the local Exchange, Newcastle units hardened a similar amount to 25s. 6d. Inquiries for Oriental stock led to a gain of 3 points to 152½, while Imperial Continental advanced 2 to 207½. In the preference group, South Suburban 5% rose 2 points to 119½, business being done at 122, and Wandsworth 5% hardened 1 to 121½. Among debentures, the two 4%'s of the Bristol Company were supported locally, and the price of both advanced 3 to 105. The 4% and 5% redeemable debentures of the British Company each gained 2 to 99½ and 111½ respectively. There were fractional falls in the stocks of two companies operating abroad—viz., Cape Town 4½% preference and South African ordinary.

A perusal of the list of stocks available at the time of writing shows that among debentures the only parcel of note on offer is that of £11,697 Weymouth new 4% at 105½ (free of stamp duty). Preference stocks are also scarce, the largest amounts on offer being £1,500 Gas Light 4% at 106 and £9,000 South Metropolitan 4% at 105, though a few small parcels giving a somewhat higher yield are attractive, including 50 £5 shares of the Godalming Gas Company at 5⅛, yielding £4 4s., and £170 York Gas Company at 98, yielding £4 2s. There is a good supply of ordinaries available, including the stocks of most of the larger undertakings.

The first accounts published by the South-Eastern Gas Corporation show that for the fifteen months ended March 31 last the gross profit amounts to £76,835, and after the payment of interest and other charges the net revenue is £59,918. Allowing for the preference dividend and the year's dividend at 6% on the ordinary shares, referred to in this Report last week, there is a balance forward of £1,965.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *April* 30.

The tar products market remains firm, with current prices at the following levels:

Pitch, 57s. 6d. per ton f.o.b.

Creosote, 3¾d. to 3⅞d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, 2s. 7d. to 2s. 8d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, 1s. 8d. to 1s. 9d.; and 90/140 pyridine bases, about 6s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

April 30.

The average prices of gas-works products during the week were: Gas-works tar, 24s. to 29s. Pitch—East Coast, 56s. 3d. to 58s. 9d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 56s. 3d. to 58s. 9d.* Toluole, naked, North, 2s. 1d. to 2s. 3d. Coal-tar crude naphtha, in bulk, North, 6¼d. to 6¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid, and salty, 2¾d. to 3d.; low gravity, 3d. to 3⅛d.; Scotland, 2⅝d. to 2⅞d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 2s. 2d. to 2s. 3d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable. to 4½d. per gallon—all in bulk *ex* works.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *April* 28.

While prices do not show any material alteration during the week a fair volume of business has been transacted and prospects for the future appear to be brighter.

Crude gas-works tar.—The actual value is 35s. to 37s. per ton *ex* works.

Pitch.—Business is off for the season, and export value is purely nominal at about 45s. to 47s. 6d. per ton f.o.b. Glasgow. In the home market, round 45s. per ton *ex* works is to-day's price.

Refined tar.—This is still being quoted at 3d. per gallon *ex* works naked, but competition continues keen.

Creosote oil.—Buying continues on a satisfactory scale and prices are firm. B.E.S.A. Specification oil is 4d. to 4¼d. per gallon; low gravity, 4d. to 4¼d. per gallon; and neutral oil, 4d. to 4¼d. per gallon—all in bulk *ex* works.

Cresylic acid.— Prompt supplies are scarce, with prices steady. Pale, 97/99%, is 1s. 2d. to 1s. 3d. per gallon; dark, 97/99%, 11½d. to 1s. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha is still quoted at from 4¾d. to 5¼d. per gallon, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 4d. to 1s. 4½d. per gallon, and 90/190 grade is 8d. to 8½d. per gallon.

Motor benzole.—Available supplies command 1s. 6d. to 1s. 7d. per gallon.

Pyridines.—90/160 grade is 5s. to 5s. 3d. per gallon, and 90/140 grade is 5s. 6d. to 6s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 9	to	0 9¼	per gallon at works
Motor "	1 4	"	1 4½	" " "
90% "	1 4½	"	1 5	" " "
Pure "	1 7½	"	1 8	" " "

Contracts Advertised To-Day.

Benzole Recovery Plant.
Bingley Gas Department. [p. 277.]

General Stores, &c.
Birmingham Corporation. [p. 277.]

Mantles.
Birmingham Gas Department. [p. 277.]

New Capital Issues.

Ascot District Gas and Electricity Company.—As will be seen from our advertising columns, Messrs. A. & W. Richards are offering for sale by tender on behalf of the Directors of this Company £20,000 of 4% perpetual debenture stock at a minimum price of issue of £102 per £100 of stock, yielding at that price £3 18s. 5d.%. Tenders must be received not later than 11 a.m. on Tuesday, May 15.

Trade Notes.

Benzole Recovery Plant for Dundee.

The Chemical Engineering and Wilton's Patent Furnace Company, Ltd., have received instructions from the Corporation of Dundee for the erection of a crude benzole recovery plant at the Dundee Gas-Works.

Newman, Hender, & Co., Ltd.

In referring in the "JOURNAL" of April 18 to the latest catalogue of the above firm, describing and illustrating their principal manufactures, we inadvertently described them as Newman, Henderson, & Co., Ltd. They are specialists in the manufacture of brass, gunmetal, cast-iron, and steel valves, cocks, and general steam and water fittings.

Gas Companies' Results in 1933.

Newquay.

The Directors of the Newquay Gas Company present accounts for the year ended Dec. 31, 1933, showing that the balance of profit available for the payment of dividends is £1,645, which they recommend should be disposed of as follows: Final dividend of 5% on the original shares, making 10% for the year; final dividend of 3½% on the additional ordinary shares, making 7% for the year. This will absorb a total of £903, leaving to be carried forward the sum of £741. The Directors report the death of one of their number—namely, Mrs. Marion Dougall—and Miss M. E. Dougall has been appointed to fill the vacancy.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. April 28. (Provincial Exchanges April 27.)	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Apl. 9	7	7	Alliance & Dublin Ord. ...	128—138	...	135—138½
374,000	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	"	Mar. 5	7	7	Barnet Ord. 7 p.c.	165—170	...	...
300,000	1	Oct. 23	1/9½	1/4½	Bombay, Ltd.	27/—29/-	...	...
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	203—208	...	207
550,050	"	"	7	7	Do. 7 p.c. max. ...	162—167	...	165—167
439,160	"	"	6	6	Do. 6 p.c. Pref. ...	142—147	...	...
50,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	79—84	...	...
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	103—107	...	...
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
357,900	"	Mar. 5	7½	7½	Brighton, &c., 6 p.c. Con. ...	161—166	...	...
540,000	"	"	6½	6½	Do. 5 p.c. Con. ...	149—154	...	151
195,500	"	"	6	6	Do. 6 p.c. B. Pref.	135—140	...	...
1,487,500	"	Mar. 5	5	5	Bristol 5 p.c. max.	114½—115½a	...	...
120,420	"	Dec. 18	4	4	Do. 1st 4 p.c. Deb. ...	104—106a	+3	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	104—106a	+3	...
328,790	"	"	5	5	Do. 5 p.c. Deb.	123—125a	...	...
855,000	"	Apl. 9	7	8	British Ord.	153—158	...	155½
100,000	"	Dec. 18	7	7	Do. 7 p.c. Pref.	153—158	...	...
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	106—111	...	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	97—102	+2	100
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	109—114	+2	109½—112
160,000	"	Jan. 8	5	5	Cambridge 5 p.c. Deb. ...	115—120	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	2—4	−2	3⅜—3⅝
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6—7	−¾	6⅜—6⅝
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	95—100	...	99—99½
626,860	"	Feb. 19	6	6	Cardiff Con. Ord.	126—131	...	...
237,860	"	Jan. 8	5	5	Do. 5 p.c. Red. Deb.	103—108	...	...
157,150	"	Feb. 19	5	6½	Chester 5 p.c. Ord.	112½—122½b	...	...
98,936	1	Oct. 9	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞	...	...
24,500	1	"	1/4⅛	1/4⅛	Do. 7 p.c. Pref. ...	19/- —21/-	...	...
609,204	1	Mar. 19	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	1⅛—1⅛	...	21/6
296,053	1	"	1/8'80	1/8'80	Do. 8 p.c. Pref.	22/6—24/6	...	24/9
1,775,035	Stk.	Feb. 19	5	6½	Commercial Ord.	120—125	...	120½
475,000	"	Dec. 18	3	3	Do. 3 p.c. Deb. ...	77—82	...	...
286,344	"	Mar. 5	5	5	Do. 5 p.c. Deb. ...	119—124	...	...
807,560	"	Feb. 19	7	7	Croydon sliding scale ...	153—158	...	155½
569,590	"	"	5	5	Do. max. div.	105—110	...	109½
620,395	"	Jan. 8	5	5	Do. 5 p.c. Deb.... ...	*131—126	...	...
542,270	"	Mar. 5	7	10	Derby Con.	175—180c	...	...
55,000	"	Jan. 8	4	4	Do. 4 p.c. Deb.	98—100c	...	...
209,000	"	Feb. 19	5	5	East Hull Ord. 5 p.c. ...	106—111	...	...
181,625	"	Mar. 5	6	6	East Surrey Ord. 5 p.c. ...	126—131	...	129—130½
175,809	"	Dec. 18	5	5	Do. 5 p.c. Deb.	118—123	...	120
1,002,180	"	Apl. 9	15	17	European, Ltd.	120—130	...	118½—122
19,342,763	"	Feb. 19	5⅞	5⅞	Gas Light & Coke 4 p.c. Ord.	26/6 -27/-f	+·/1½	26/6—26/10½
2,600,000	"	"	3½	3½	Do. 3½ p.c. max.	87—90	...	87—89
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref. ...	103—106	...	104½—104⅝
6,102,497	"	Dec. 18	3	3	Do. 3 p.c. Con. Deb. ...	84—87	...	85½—86½
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb. ...	116—119	...	117⅜
3,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	...	115½—116½
270,466	"	Mar. 5	6	6	Harrogate New Cons. ...	125—130	...	...
82,500	"	Mar. 5	7	7	Hastings & St. L. 5 p.c. Conv.	147—152	...	150
258,740	"	"	5½	5½	Do. 3½ p.c. Conv.	115—120	...	...
140,000	1	Apl. 23	1/7½	1/7½	Hongkong & China, Ltd. ...	28/6—31/6*	—·/6	30/-
219,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	128—133	...	...
5,600,000	"	Nov. 6	14	10	Imperial Continental Cap.	205—210	+2	203—209
223,130	"	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	89—94	...	...
235,242	"	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	169—174	...	...
2,167,410	"	Mar. 5	6	6	Liverpool 5 p.c. Ord. ...	130—132b	...	...
245,500	"	Dec. 18	5	5	Do 5 p.c. Red. Pref. ...	101—111b	...	...
306,088	"	July 17	4	4	Do. 4 p.c. Deb. ...	101½—103½b	...	...
165,736	"	Feb. 19	8	10	Maidstone 5 p.c. Cap. ...	180—190	...	...
56,176	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	72—77	...	...
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean	9 11	...	...
392,000	—	Apl. 3	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	96 -101	...	...
231,978	Stk.	Feb. 19	5	5	M. S. Utility "C." Cons. ...	113—118	...	...
818,657	"	"	4	4	Do. 4 p.c. Cons. Pref.	95—100	...	...
360,075	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	"	"	5	†5	Do. 5 p.c. Deb. ...	117—122	...	...
675,000	"	21 May '31	†6	6	Montevideo, Ltd.	60—70	...	...
2,061,315	"	Mar. 5	5	5½	Newcastle & Gateshead Con.	25/3—25/9 f	+·/1½	...
682,856	"	"	4	4	Do. 4 p.c. Pref. ...	99 -101d	...	...
776,706	"	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	92—98d	...	...
277,285	"	Nov. 6	5	5	Do. 5 p.c. Deb. '48 ...	105—107d	...	...
274,000	"	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	106—108a	...	...
204,940	"	Mar. 19	7½	7½	North Middlesex 6 p.c. Con.	155—160	...	...
394,160	"	Feb. 5	5	5	Northampton 5 p.c. max. ...	99 -104	...	...
300,000	"	Dec. 4	7	†9	Oriental, Ltd.	150—155	+3	...
316,617	"	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	165—170	...	...
504,416	"	Feb. 19	8	8	Portsm'th Con. Stk. 4 p.c. Std	168—173	...	...
241,446	"	"	5	5	Do. 5 p.c. max. ...	105—110	...	...
*114,000	"	Feb. 19	5	5	Preston 5 p.c. Pref.	103—108	...	...
686,312	"	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	87—92	...	...
389,813	"	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	88—93	...	90½
150,000	10	Mar. 19	6	6	San Paulo 6 p.c. Pref. ..	7—8	...	7⅞ 7⅞
1,736,968	Stk.	Mar. 19	6	6	Sheffield Cons.	134—136	...	...
95,000	"	Jan. 8	4	4	Do. 4 p.c. Deb. ...	94—98d	...	...
133,201	"	Feb. 19	2½	5	Shrewsbury 5 p.c. Ord. ...	135—140	...	...
90,000	10	June 12	15	14	South African	2½—4½	—½	8½
6,709,895	Stk.	Feb. 19	5	7	South Met. Ord.	131—134	...	131—132½
1,135,812	"	"	6	6	Do. 6 p.c. Irred. Pf.	138—143	...	...
850,000	"	"	4	4	Do. 4 p.c. Irred. Pf.	102—106	...	104—104¾
1,895,445	"	Jan. 8	3	3	Do. 3 p.c. Deb. ...	84—87	...	85½—86¼
1 000,000	"	Jan. 22	5	5	Do. 5 p.c. Red. Deb.	114—117	...	115—115½
209,820	"	Mar. 5	8½	8½	South Shields Con.	166—167d	...	...
1,543,795	"	Feb. 19	6	6	South Suburban Ord. 5 p.c.	130—133	...	130—132
512,825	"	"	5	5	Do. 5 p.c. Pref.	117—122	+2	119—122
300,000	"	"	—	4	Do. 4 p.c. Pref.	103—108	...	106
866,837	"	Dec. 18	5	5	Do. 5 p.c. Deb.	120—125	...	122½
100,000	"	"	4	4	Do. 4 p.c. Deb.	103—108	...	...
647,740	"	Mar. 5	5	5	Southampt'n Ord. 5 p.c. max.	109—114	...	...
121,275	"	Dec. 18	4	4	Do. 4 p.c. Deb.	100—105	...	...
350,000	"	Mar. 5	5½	5½	Swansea 5½ p.c. Red. Pref.	106—111	...	...
200,000	"	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	103—108	...	...
1,076,490	"	Mar. 5	6½	6½	Tottenham and District Ord.	148—153	...	...
409,835	"	"	5½	5½	Do. 5½ p.c. Pref. ...	123—128	...	...
69,235	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
199,005	"	Dec. 18	4	4	Do. 4 p.c. Deb. ...	97—102	...	...
85,701	"	Apl. 9	6	6	Tuscan, Ltd. 6 p.c. Red. Db.	90—100	...	...
349,110	"	Mar. 5	7	7	Uxbridge, &c., 5 p.c. ...	150—155	...	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	112—117	...	...
1,322,220	"	Mar. 5	7	7	Wandsworth Consolidated	155—160	...	156—157
1,096,373	"	"	5	5	Do. 5 p.c. Pref.	119—124	+1	121—123½
1,317,964	"	Dec. 18	5	5	Do. 5 p.c. Deb.	120—125	...	...
158,400	"	Mar. 5	5	6g	Winchester W. & G. 5 p.c. Con.	115—120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f*—The quotation is per £1 of stock. *g.*—Paid £3, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year.

STOCK FOR SALE BY TENDER.

By Order of the Directors.

THE ASCOT DISTRICT GAS AND ELECTRICITY COMPANY.

Messrs. A. & W. RICHARDS

are Instructed to OFFER FOR SALE BY TENDER

£20,000

FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

Minimum Price of Issue, £102 per £100.

Yielding at that Price, £3 18s. 5d. per cent.

Prospectus and Form of Tender (which latter must be sent in by 11 o'clock on Tuesday, 15th May) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

CONTRACTS OPEN.

BINGLEY URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

CRUDE BENZOLE RECOVERY PLANT.

TENDERS are invited for the Installation of a CRUDE BENZOLE RECOVERY PLANT.

Specification, Form of Tender, and further information may be obtained from the undersigned.

Tenders to be received not later than Saturday, May 12th, 1934.

The lowest or any Tender not necessarily accepted.

J. B. BALMFORTH,
Engineer and Manager.

Gas-Works,
Bingley, Yorks.,
April 27, 1934.

CITY OF BIRMINGHAM.

THE City of Birmingham Corporation are prepared to receive TENDERS for the Supply and Delivery of STORES, as set forth below, for a period of Twelve Months from July 1, 1934.

Conditions of Contracts and Forms of Tender may be obtained on application as follows:—

To the SUPERINTENDENT ENGINEER, BATHS DEPARTMENT, Kent Street, Birmingham, for:

Schedule No.
1. Towels, Dusters, and Scourers.

To the SECRETARY AND COMMERCIAL MANAGER, ELECTRIC SUPPLY DEPARTMENT, Dale End, Birmingham, for:

Schedule No.
2. Files, Hack Saw Blades, and Engineers' Tools.
3. Belting, Balata and Leather.

To the GENERAL MANAGER AND SECRETARY, GAS DEPARTMENT, Council House, Edmund Street, Birmingham, for:

Schedule No.
4. Lead (Red and White), Linseed Oil, &c.
5. Sheet Glass.
6. Sash Cord, Rope String, and Tarred Yarn.
7. Clogs.
8. Gas Mantles.

To the CITY ENGINEER AND SURVEYOR, Council House, Birmingham, for:

Schedule No.
9. Hammer Heads, Shovels, Forks, &c.
10. Buckets, Watering Cans, Paint Kettles, Oil Bottles, and Riddles.
11. Paint and other Brushes.
12. Road Watchmen's Lamps.
13. Brooms, Mop Stails, File Handles, Hammer, Sledge, and Pick Shafts.

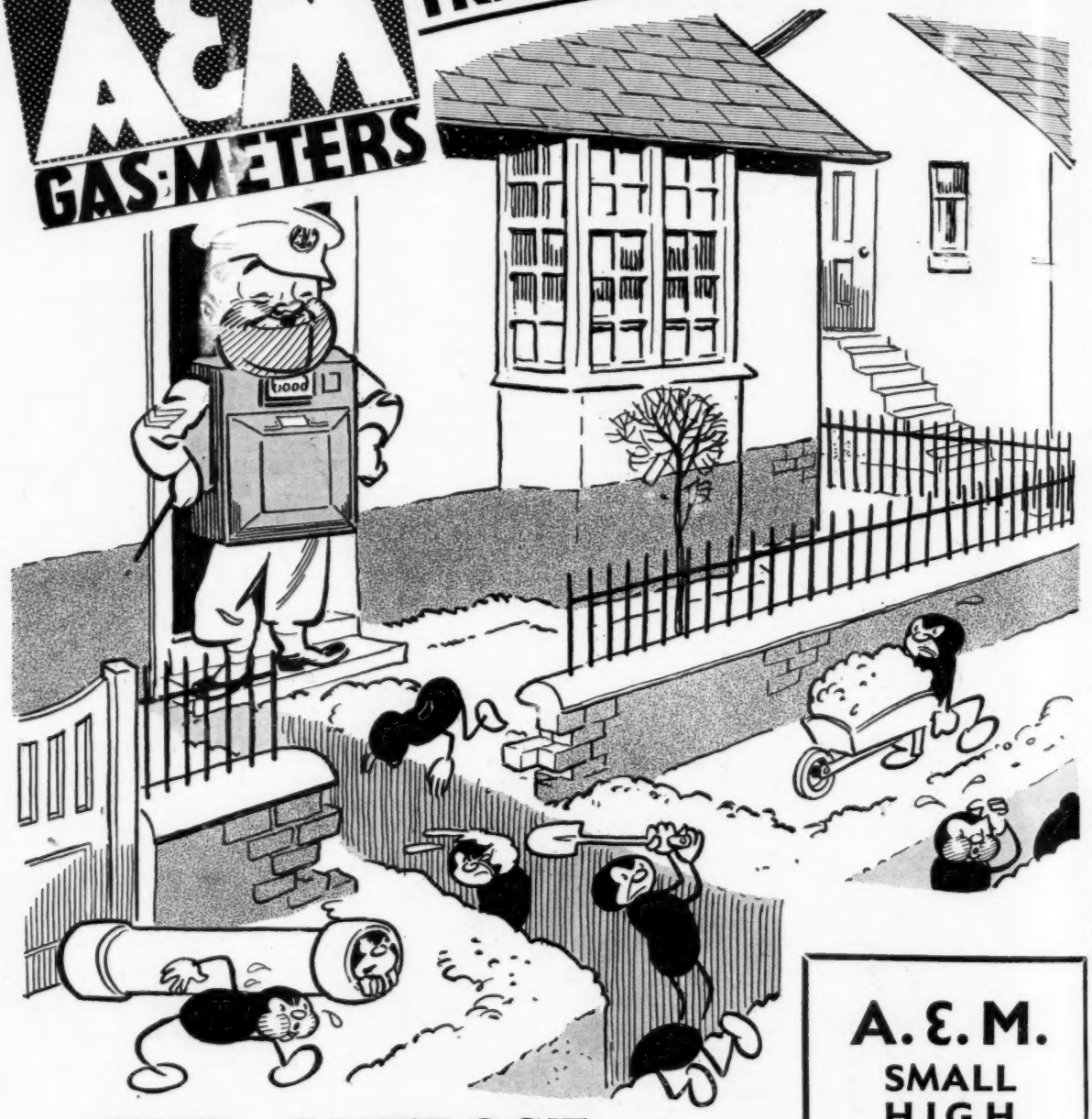
To the GENERAL MANAGER, TRAMWAYS AND OMNIBUS DEPARTMENT, Council House, Congreve Street, Birmingham, for:

Schedule No.
14. Screws and Cotter Pins.
15. Drysaltery.
16. Leathers and Sponges.
17. Cotton Waste.

The TENDERS must be enclosed in a sealed cover, addressed as directed in the General Conditions, and delivered NOT LATER THAN SATURDAY, MAY 12, 1934.

A&M GAS METERS

TRAIN THE THERMS



THE OUTPOST

Therms are going to occupy a great deal of new territory this year. If their operations are to be profitably controlled, Sergt. A.E.M. Meters should be sent out with the advance party to receive them.

Not a therm escapes when the Sergt.'s in command.

ALDER & MACKAY LIMITED

MAKE METERS OF METICULOUS MEASUREMENT

A.E.M. SMALL HIGH CAPACITY METERS

The introduction of the Small H.C. Meter is the latest development in the tendency to give greater capacity in relation to case size. The speed has been increased, but the essential parts have all been strengthened and every precaution taken against premature breakdown.

Full particulars will be sent on request

ALDER & MACKAY LTD., EDINBURGH, LONDON & BRADFORD